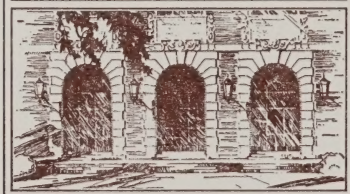



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	Stoney, F. S., Lieut.-Col. late R.A.	
	Terry, F. S., Major, late 25th Regiment	
	Strange, T. Bland, Major-General	

INDIAN FORCES.

rch, W. B., Major Bengal Staff Corps	Cologan, J. F. Fitzgerald, Lieut.-Col. Bengal S.C.
ebbery, G. V., M.C., Lt.-Col. late Bengal Staff Corps	Sewell, H. Fane H., Lt.-Col. Madras Staff Corps, Hyderabad Contingent
ordon, J. J. H., C.B., Brigadier-General Bengal Staff Corps	Clutterbuck, T. St. Q., Major Bengal Infantry
loyd, E., Captain 1st Punjaub Cavalry.	Prendergast, G. A., Col. Bengal Staff Corps
acGregor, Sir C. M., K.C.B., C.S.I., C.I.E., Maj.-Gen., Quarter-Master-General, Army Head Quarters, India	Heyland, A. Rowley, Major 1st Bombay Lancers
ave, E. S., Major 18th Beng. Cav.	Collen, E. H.H., Capt. Bengal S.C., First Assistant Military Secretary, Government of India
thell, R., Lieut.-Colonel Bombay Staff Corps	Macaulay, G. W., Lt.-Col., late Comt. 1st Scinde Horse
starchan, E. S., Lt.-Col. Bom. Staff Corps	Crookshank, A. C. W., Lt.-Col. Bengal Staff Corps, Assistant Military Secretary, Government of India
atts, J. G., Colonel Bombay Staff Corps	Travers, E. A., Capt. Ben. S.C.

YEOMANRY CAVALRY.

oft, R. B., F.L.S., F.R.M.S., Major Herts	Portman, Hon. W. H. B. Col. late West Somerset
ldmay, Sir H. B. P. St. John, Bart., Colonel late Hampshire	

HON. ARTILLERY COMPANY.

Raikes, G. A., Captain, Instructor of Musketry.

VOLUNTEER CORPS.

Artillery.

Pooley, H., Captain late Cheshire
Rutley, J. Lewis, Major 2nd Middlesex

Engineers

Macliver, D., Lieut.-Colonel 1st Gloucester

Rifles.

Yorke, P. C., Major and Adj. 1st Bucks
Acland, Sir Thomas Dyke, Bart., M.P., Col. 3rd Devon
Davidson, D. C.B., Col. Edinburgh City
Twyford, H. R., Lieut.-Col. late Hampshire
Hardinge, C. S., Viscount, Col. A.D.C., 1st Kent
Sweny, Eugene, Capt. 3rd Kent
Crawley, T. G. Major, 8th Foot and Adj. 7th Lanark
Hutchinson, J., Hon. Col. 1st Vol. Batt. Lanc. Fusiliers
Halford, Sir Henry St. J., Bart., Lieutenant-Col. 1st Vol. Batt. Leicestershire Regt.
Vickers, C.B., Lt.-Col. 10th Vol. Batt. K.R.R.C.
Tomkins, A. S., Capt. late 1st Middlesex Victorias

Verity, C. F., Major late 2nd South Middlesex
Page, Sam. Flood, Major late London Scottish
Lombard, G. C. S., Major and Adj. 5th Vol. Batt. K.R.R.C.
Baker, James, Lt.-Col. late Cambridge University
White, C. W., Capt. 8th Vol. Batt. K.R.R.C.
Roupeil, C. M., Capt. late 23rd Inns of Court
Enfield, Viscount, Honorary Col. 4th Vol. Batt. Middx. Regt.
Baylis, T. Henry, Q.C., Lt.-Col. late 18th Middlesex
Cronin, Alfred C., Capt. 19th Middlesex
Leighton, Sir Fredk., Colonel 20th Middlesex P.B.A.
Vincent, C. E. Howard, late Lieut.-Col. 13th Middlesex
Wright, C. I., Lieut.-Col. late Nottingham
Thomas, W. H., Capt. late 1st Surrey
Dartmouth, Earl of, Capt. late Stafford
Rouse, Rolla, Major late 2nd Suffolk
Harding, Charles, F.R.G.S., Major late 19th Surrey
Longstaff, Llewellyn W., F.R.G.S., Lieut.-Col. late 1st East York

COLONIAL RESERVE FORCES.

Militia.

Gore, Augustus F., C.M.G., Lt.-Governor of St. Vincent, Lt.-Col. Barbadoes and British Guiana.
Brunel, A., Lt.-Col., Active Militia, Canada, Lt.-Col. Colonial Reserve Forces, F.R.G.S.
Montizambert, Charles E., Lt.-Col., Captain B. Battery, School of Gunnery Quebec.
Imlack, R. W., Col., British Guiana.
Turnbull, J. F., Colonel Canadian Hussars
Sargood, F. T., Major Victoria Field Artillery, Melbourne.

GOLD MEDALLISTS.

Naval.

1876. Commander G. H. U. Noel, R.N.
1878. Captain P. H. Colomb, R.N.
1880. Captain the Hon. Edmund R. Fremantle, C.B., C.M.G., R.N.
1882. Captain Lindesay Brine, R.N.
1884. Captain Charles Johnstone, R.N.

Military.

1875. Captain H. W. L. Hime, R.A.
1877. Lieut. John Ross-of-Bladensburg, Coldstream Guards.
1879. { Captain Emilius Clayton, R.A.
 { Major T. Fraser, R.E.
1881. Captain J. K. Trotter, R.A.
1883. ———

1884-85.

Subject for the Military Prize Essay :—

“Should the European Army in India continue as at present constituted, or should it be converted in whole or in part into a local force?”

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VICE-ADMIRAL SIR J. EDMUND COMMERE^LL, *N.C.*, K.C.B.,
in the Chair.

THE INTERIOR ECONOMY OF A MODERN MAN-OF-WAR.

By Lieutenant CHARLES CAMPBELL, R.N.¹

WHEN first asked by the Council if I would undertake the task of writing a paper on the interior economy of a man-of-war, it occurred to me that it was a subject upon which there might be a very large difference of opinion, and with which every naval Officer must be familiar. The answer was, that there was so much the more reason for placing the opinions arrived at by an individual before a number of members of the profession gathered together for the purpose of discussing the subject, so that they might be combated, thoroughly sifted, and some definite conclusion arrived at.

Of one thing my experience has convinced me, that every naval Officer does his utmost for the honour and welfare of the ship in which he is serving; and this paper is only intended to humbly assist in establishing and ventilating the best means of conducting the interior economy of a man-of-war, and the best direction for the energy of her Officers and men, so that she may become a credit to them, and to that Service in which we are proud to serve. The greater part naturally consists of what is actually going on in all ships from day to day, and I claim no originality for what I have only tried to make accurate. I have again, as in former papers, followed the idea of Montaigne, and shall place before you a nosegay of culled flowers, bringing nothing of my own but the thread that ties them.

A man-of-war—it matters little of what nationality—has become, even to those who find no difficulty in following the rapid changes in naval architecture, a complex machine; and there is little happening at the present time to persuade us to believe in the doctrine of finality so far as a type of shipbuilding is concerned, or to predict that the man-of-war of the future will be more simply constructed. But, while more engineering skill will be required for maintenance and

¹ Now Commander Campbell, H.M.S. "Alexandra."

preservation, every step that is taken lessens the necessity for the employment of seamen of the old school, for drills and exercises aloft, to keep them efficient, and, in fact, for any exercise that is not actually connected with the fighting powers of the ship. That is to say, in the sailing days, a great part of the training had reference to the safety of the ship under sail, beating off a lee shore, reefing, furling, &c., in heavy weather; whereas now, even a masted ironclad, if it comes on to blow hard enough to endanger the ship, she is generally placed under steam and fore and aft storm-canvas, bow to the swell, and so rides out the gale.

The real difficulty in dealing with the general consideration of the interior economy of a man-of-war is the diversity of class and the varying conditions of service, together with the fact that we have not got to train men for any special class, but for the general service of the whole fleet. On the one hand we have the mastless turret vessel, on the other the cruising corvette. Added to this is the fact, that we are in a tentative and changing stage; and a review of the past tells us that we are likely to continue in that stage. Therefore in the same manner that the speed of the fleet is regulated by the slowest ship, so inversely the quantity of seamanship in the seaman of to-day and of the future must be regulated by the ship that requires the greatest amount of such knowledge. The interior economy of a man-of-war must always be first considered with reference to rendering the ship a perfect fighting machine; next as to the safety; and, lastly, as to the cleanliness, preservation, and outward appearance of the ship.

First, a fighting ship; 2nd, a smart ship; and last, but not least, a clean and well-kept ship.

The same rules govern the fighting exercises of every ship of war, no matter what her class or build: and they are clearly laid down in the Gunnery Manual. They are carried out by systematic instruction at intervals to the whole ship's company, in the preparation for battle, daily, and continually to smaller bodies of men in the details of heavy gun, rifle, cutlass, and pistol exercises, and small-arm companies. The cleanliness, preservation, and appearance may be also said to be guided by the same rules in all ships. Systematic organization, co-operation, and routine are the means employed, and the machinery by which these are carried out is constantly oiled and adjusted so as to avoid friction.

Of these elements organization and routine take precedence as they start the machinery, but to co-operation is given the honour of achieving the result; and on the co-operation of all the atoms employed depends the efficiency of a man-of-war, no matter what her name or nation.

To assist us in the consideration of this element, we cannot do better than to refer to a note on the first chapter of the first book of Adam Smith's "Wealth of Nations," which appeared in 1840, by the well-known political economist Edward Gibbon Wakefield. He says: "All improvements in the productive powers of labour, including division of employments, depend upon co-operation. Co-operation appears to be of two distinct kinds: first, such co-operation as takes

place when several persons help each other in the same employment. Secondly, such co-operation as takes place when several persons help each other in different employments. * * * *

"In all operations it is absolutely necessary that many persons should work together at the same time, in the same place, and in the same way."

Now, men may co-operate together to hoist out a boat, gun, or other heavy weight, and the action of such co-operation is visible to all concerned, but in the interior economy of a man-of-war several men, or bodies of men, are employed at different times, in different pursuits, and in different parts of the ship.

A complex operation of the mind is necessary on the part of the Commanding Officer to ensure each of these parts working effectively so as to produce the best results. In a ship-of-war the formality of regular and systematical arrangement of the component pieces must be observed, and the whole must, so to speak, be held together in a cloak of essential unity, or, as Boyce expresses it,

"Systems enclosed in his perception roll,
Who's all enforming mind directs the whole."

It must again be observed that two separate forms of co-operation are necessary: one the co-operation of the various employments to form a whole; and the other the co-operation of individuals told off to the various employments; that is to say, the knack of accurately estimating the number of hands necessary for the performance of a job of work. Now, let anyone consider the question of legislating, day after day, for a ship's company of 700 men, so that none may be idle, none overworked, and all gradually assisting in perfecting the fighting powers, smartness, and cleanliness of the ship. Consider the immense variety of occupations, and the importance of a convenient distribution of them. Reflect on the task imposed on the director and organizer. Yet this object is accomplished through the agency of men who think each of nothing but his own immediate interest; who, with that object in view, perform their respective parts with cheerful zeal, and combine, unconsciously, to effect an object the vastness of which it would bewilder them even to contemplate.

PAST.

It is not possible in the space available, even if it were necessary, to give anything like a detail of what has occurred in past ages. It will, I hope, be sufficient to glance at the main points of difference between the first half of this century and the present time. That will be taking the best of the sailing period, before the influence of steam had become palpable to the Navy. It is upon these data and on this comparison that I shall venture to predict the future.

During the whole of that period the system of manning was a serious drawback to the perfection of the interior economy of a man-of-war. Ships were frequently months unable to complete their complements, and, after they got their men, much time was spent in thrashing them into shape. Speaking generally, the gunnery system was of the loosest description, and each ship improvised the drills and exercises

that suited them best. There were no standard watch-bills, and the stationing of the ship's company was left very much to the Commander or First Lieutenant. That many ships are reported to have arrived at a high standard of efficiency is due more to the Officers who commanded them than to any general system of organization or training.

That health and cleanliness have long been considered to have an important place in the interior economy, even amongst the exhilarating and disturbing influences of a great war, we have ample evidence ; but I need only quote from the Regulations of 1815 to 1826 in order to establish the fact, and it may also convey some idea of the management in those days.

Chapter IV, Article 1, says :¹—

“ As cleanliness, dryness, and good air are essentially necessary to health, the Captain is to exert his utmost endeavours to obtain them for the ship's company in as great a degree as possible. He is to give directions that the upper decks are washed very clean every morning, and that the lower decks are washed occasionally, when the weather will admit of their being properly dried ; they are to be swept twice, at least, every day, and the dirt collected on them thrown overboard. The hammocks are to be carried upon deck, and the ports are to be opened whenever the weather will admit of it ; and no more chests or bags than shall be necessary for the comfort of the men shall be kept on the lower gun-deck, that as few interruptions as possible may be opposed to the free circulation of air ; and the hold and store-rooms are to be ventilated by wind-sails.

“ The ship is always to be pumped dry, the pump-well frequently swabbed, and a fire, with proper precautions, let down to dry it. If the weather should prevent the lower deck ports from being opened for any considerable time, fires are to be made in the stoves supplied for that purpose, and the lower decks are to be kept as dry and clean as possible.

“ The Captain is to be particularly attentive to the cleanliness of the men, who are to be directed to wash themselves frequently, and to change their linen twice every week. They are never to be suffered to sleep in wet clothes or wet beds, if it can possibly be prevented ; they are frequently, but particularly after bad weather, to shake their clothes and bedding in the air, and to expose them to the sun and wind.”

The rating of ships and the strength of their complement according to the number of guns they carried, also belongs to the past.

With guns from ten to twenty times the power, owing to improved machinery, we only require the same number of men per gun ; and this makes a vast difference in carrying out the interior economy.

FROM PAST TO PRESENT.

In proceeding from the consideration of the interior economy of the past to that of to-day, we must not fail to pay a just tribute to the foresight of those who placed an indelible barrier between these two

¹ “ Naval Instructions,” 1815 to 1826, Radstock Collection, R.U.S.I.

periods. I allude to the Committee of naval Officers who sat in 1852, to consider the expediency and practicability of engaging men and boys for longer terms of continuous service; and to the Board who ordered that Committee and framed the Order in Council of the 1st April, 1853. They addressed the Crown as follows:—

“We fully concur in the view expressed by the Committee, and we are of opinion that it is essential to give the Royal Navy a permanent constitution, in order that it may be brought to a higher point of organization, efficiency, and discipline, and thus be enabled at critical junctures to fulfil the expectations of your Majesty and the country. We humbly submit that all boys who hereafter enter the Navy be required to engage for a period of ten years’ continuous and general service, from the age of 18, in addition to whatever periods may be necessary until they attain that age.”

Nor must we forget the pioneers who led the way. The humble efforts of Thomas Urquhart, in his letters to Lord Melville and Mr. Wilberforce, in 1815, on the subject of impressment; and the larger and still more weighty work by Captain Anselm John Griffiths, R.N., on “Impressment Fully Considered, with a View to its Gradual Abolition and the Substitution of Voluntary Service,” written in 1826. To these and many others, who have devoted their lives to the improvement of the interior economy of a man-of-war, and the comfort of the men, we owe the fact that we are now a purely voluntary service, the numbers only being limited by the demand.

PRESENT.

The regulations for the administration of all connected with the interior economy of a man-of-war are laid down in the Queen’s Regulations and Admiralty Instructions, which are officially published, and therefore I will not do more in this paper than make a reference to their existence. Combined with the daily and weekly routine, they are the motive power which drives the machinery of the interior economy. It will, I hope, be sufficient to give a short outline of the descending scale of responsibility through the various grades who form the executive, adding a description of the routine, as carried out in ironclad ships.

The arrangement of responsibility in the interior economy of the man-of-war of to-day may be briefly stated as follows:—

The Captain is responsible for all.

The Commander, or, where none is borne, the First Lieutenant, is responsible to the Captain for all.

With reference to the clothing and personal cleanliness of the men, and their conduct at gun and sail drill, the Lieutenants are responsible through the Commander, to the Captain, for the regulation of the details of their respective divisions, quarters, masts, or deck party.

The detail of cleaning ship throughout is regulated by the Commander, assisted by the First Lieutenant below the upper deck, and by the mates of decks, now nearly always warrant officers.

The guns are under the care of the Gunnery Lieutenant, who also carries out the detail of instruction in gunnery ordered by the Captain

and Commander, and the torpedo where there is no Torpedo Lieutenant.

The torpedo work (where a Torpedo Lieutenant is borne) is carried out by him in addition to his other work, with a special allowance for *the* extra. The duties connected with torpedoes have not *yet* been considered sufficient to excuse the Officer who performs them.

The First Lieutenant carries out the detail of instruction in seamanship to the midshipmen, ordinary seamen, and boys, subject to the approval of the Captain and Commander. The remaining Lieutenants take their turns as Officer of the watch, usually at an average of six hours a day, and while performing that duty are in charge of the ship, and responsible to the Captain for every detail connected with her.

The Sub-lieutenants assist the Lieutenants in their general duties—there usually being one in large ships to assist the Navigating Officer, one in charge of the steam pinnace. The senior performs the important duty of senior member of the gun-room mess.

The midshipmen, besides receiving instruction, keep regular watch under the Lieutenants as far as it does not interfere with their instruction, and, with the same restriction, carry out the boat duty.

It may be generally stated, that the heads of other departments are responsible to the Captain for the details connected with their respective departments. The Staff Commander or Navigating Lieutenant, for the correct navigation of the ship from port to port, also assists in preserving her station in the fleet when the hands are on deck and in action. He is also responsible for the correct keeping of the ship's log, and the demands for, and expenditure of, the warrant officers' stores.

The Fleet or Staff Surgeon, for the health of the ship's company and details connected with the sick bay or ship's hospital, regulation of the sick list, sending men to shore hospitals, &c.¹

The Paymaster, for all connected with the payment, clothing, and provisions of the ship's company, the ship's books, certificates, record of conduct, savings, allotments, remittances, &c., &c.

The Chief Engineer, for the machinery, boilers, coal, &c.

The warrant officers may now be said to come under two heads: first, the gunner, boatswain, and carpenter of the ship, who have respectively charge of the stores coming under their warrant; secondly, the supernumerary warrant officers, who perform the duty of mates of decks, &c.

Below this again come the chief petty officers, each having his function in his own part of the ship.

The master-at-arms, who is the head of the ship's police, an entirely independent body, necessitated by the existence of crime and its punishment.

The chief gunner's mate, who is also usually a gunnery instructor, and who assists the Gunnery Lieutenant in the details of instruction.

The chief boatswain's mate, who assists the boatswain, and who is generally in charge of all that relates to the upper deck and outside of

¹ This and the following paragraph, relating to the Paymaster, were added subsequent to the meeting.—ED.

the ship. The chief captain of the forecastle, who also, under the boatswain, has charge of all that relates to the head booms and anchor gear. The chief signalman, who in flag-ships has charge (under the Flag Lieutenant and signal mate) of the signal department. The chief quartermaster, who has charge of the hand wheel, tiller ropes, compasses, &c., under the Navigating Officer. The chief carpenter's mate, under the carpenter, has charge of the carpenter's crew.

The seaman schoolmaster, who is in charge, under the Chaplain, of the education of the boys and voluntary study of the men.

The ship's steward, who is in charge, under the Paymaster, of the victualling and storage, and issue of clothing. The ship's cook, who is in charge of the galley and general cooking for the ship's company.

These last three do not take military command.

The chief petty officers mess by themselves, and have a boy in each watch told off to assist in cleaning, &c. They are an important item in the distribution of ulterior responsibility in a man-of-war.

The next, and perhaps the most important step, as far as the good order of the interior economy is concerned, is the grade of first-class working petty officer, such as captains of the tops, forecastle, quarter-deck, gunner's mates. They superintend and are responsible for the individual work done by, and the conduct of their men. The captains of the tops also look after all gear above the top on their respective masts, the gunner's mates taking the main, and the captains of the forecastle the foreyards and lower rigging. Besides this, they are, as a rule, captains of guns, and not unlikely markers of the small-arm companies. The ship's corporals assist the master-at-arms as "ship's police."

The quartermasters keep regular watch under the Lieutenants and midshipmen. They look after the steering at sea, and are placed in the chains as leadsmen in narrow channels, proceeding in and out of harbour, &c., and report the times on the routine board. They assist the chief quartermaster and also the Navigating Officer.

The boatswain's mates also keep regular watch; they convey by pipe and voice all orders that necessitate turning up the hands, watch, or part of a watch, and assist in seeing ropes manned, yards trimmed, &c.

The remaining first-class petty officers hold individual ratings such as Captain's coxswain, coxswain of the launch, who look after their boats and crews; and the captain of the hold, sailmaker, ropemaker, carpenter's mates, caulker, armourer, blacksmith, who are rated first-class petty officers rather to give them position and pay than military command.

The first-class petty officers are usually divided into two messes, one on each side of the deck.

The second-class petty officers assist the first in connection with their duties aloft and on deck; and have besides the very important duty of petty officers of the messes.

The leading seamen are a class of aspirants for petty officers' rate, from among the best of the able seamen, who are required to pass a severe examination in seamanship, and show by their conduct, zeal, and ability that they merit being admitted to this, the first grade of

responsibility. They are frequently in charge of small parties of men such as "a hand from each part of the ship," &c., and are placed in the chains next to the quartermasters.

Three of them in large ships are captains of the crosstrees, and in that capacity a good deal of the responsibility for the upper yard and mast work comes upon their shoulders.

The able seamen form the nucleus of the strength of the ship's company. They have concluded their arbitrary instruction in seamanship, except that conducted with all hands, or the watch, but they are still systematically instructed in gunnery and small-arm drill, and mostly gain the rating of trained men.

The ordinary seamen and boys, though useful as higher numbers in the guns' crews, powder men, royal yard men, boats' crews, and in cleaning ship, can scarcely be said to add materially to the efficiency of the ship.

The stokers on board a man-of-war may be said to have a distinct, if not a separate organization. They work in the stoke-hole and engine-room, and tend fire mains at fire quarters and in action; working on deck with the hands at general exercise aloft, in and out boats, &c.

The above, I hope, fairly describes the distribution of work and responsibility of the blue-jacket element of a ship.

The useful and important work done by the corps of Royal Marine Artillery and Light Infantry cannot be omitted in dealing with the interior economy of a man-of-war.

They furnish the guard by whom the duty of sentry in all parts of the ship is performed under the non-commissioned officers and Officers on duty.

The working party under a sergeant are usefully employed with the remainder of the hands or watch.

They are stationed at guns, and as small-arm men on the upper deck in action, and assist on deck at general exercise, in and out boats, &c.

They have separate messes, which are usually termed the "barracks." Each mess is in charge of a corporal, the sergeant-major and sergeants having a small mess to themselves.

The daily and hourly interior economy of a man-of-war is regulated by routine which, under ordinary circumstances, does not alter during the commission.

The routine board, probably resembling that which has been prepared for the illustration of this paper, is usually framed and hung up in a conspicuous place on the main deck; and the duties, drills, &c., apportioned to the several times are, when the outside exigencies of the Service permit, rigidly carried out.

The routines are organized under the heads of summer and winter, sea and harbour.

It will be observed that in the sea routine the cleaning commences earlier, namely, at 4 o'clock; but the men employed belong only to one watch, as the men who had the middle watch are not turned out till after the decks are done. The decks having been cleaned, and the sails re-set, the awnings are spread, and at 6.15 the hammocks are

stowed, after which the bugle sounds for the cooks of the messes to repair to the coppers, and the hammocks of the guard and subordinate officers are stowed. At 6.45 all hands go to breakfast.

At 7.15, that is, when the ship's company have had half an hour to breakfast, the watch coming on deck (forenoon watch) clean in a blue working dress, and the duty men, namely, quartermasters, signalmen, duty boats' crews, clean, in the rig of the day. The watch below clean the lower deck, and also what are now known as the flats or compartments formed by watertight bulkheads.

At 7.30 the forenoon watch are fallen in, put through the station for one evolution, and then clean the bright work.

At 8 o'clock all hands go to quarters, clean guns. The pump gear is cleaned on Mondays and Wednesdays, and then the hands are piped to clean. The roll is beat, and all hands clear off the lower parts of the ship, when the Commander and First Lieutenant go the rounds. "Ready for morning quarters" is reported to the Captain, and the bugle is sounded to divisions. The men are all inspected, and reported correct by the Lieutenants, after which prayers are read on the quarter-deck or main-deck in rainy weather.

The various routines differ mostly during the period from commencing to scrub decks till time for quarters.

In harbour during the summer the hands are fallen in, and the upper and half deck cleaned at 4.50, and the duty boats' crews clean their boats out. The hammocks are stowed at 6, and the men breakfast at 6.30. At 7 the forenoon watch, clean, in a blue working rig, duty men and boats' crews in the rig of the day, and the watch below clean mess deck and flats.

At 7.15 the forenoon watch and duty boats' crews fall in, clean bright work, and if top-gallant masts are down, overhaul top-gallant rigging. At 7.50 the upper yard men fall in, and then the daily morning evolution is performed.

This exercise consists, as will be seen by reference to the weekly routine, of replacing whatever has been sent down the night before. On Monday and Tuesday royal yards, on Wednesday and Thursday cross upper yards from top-gallant masts down. On Friday cross royal yards, then prepare for action aloft by sending down top-gallant masts and all booms, bracing up yards, running in head booms and toggling braces. In the performance of these evolutions, the watch on deck always perform the duty aloft.

The morning evolution complete and the yards square, the guns come in for their share of polish as at sea, and then the hands clean, after which the rifles, pistols, cutlasses, are cleaned, and on Tuesdays and Thursdays the bugle is sounded to put belts on, and the small-arm men are inspected by the Lieutenant-Captains of the companies; one of these days being devoted to exercising landing parties consisting of small-arm men, field guns, pioneers, bearers, band, &c. After prayers the routines are much alike till noon, except that in harbour on Monday there is general exercise aloft; on Wednesday an anchor and cable is laid out, or the boats are manned and armed, at the expiration of the dinner-hour; and on days when the weather permits of the sails

being loosed, they are furled at 11; and that at sea only one watch is on deck, and in harbour both watches. At 9.45 there is a watch-drill consisting of shifting a spar or sail, and at 10, the regular drills of the ship, consisting of the instruction of untrained men, and a portion of the quarters exercised under the Gunnery Lieutenant and instructors. The ordinary seamen and boys are instructed in seamanship under the First Lieutenant and instructors. This party is frequently exercised aloft, loosing, reefing, and furling, sending down royal yards, &c. The remaining hands or watch are told off to the various jobs necessitated by wear and tear. At 11 the cooks of the messes of the watch below get the spirits up, and at 11.30 the decks are cleared up, all work put away, and the wood and brick work touched up.

At a quarter to 12 the cooks repair to the coppers, and at 12 o'clock all hands are piped to dinner. The grog is served out to those who are allowed it at 12.30, and smoking is permitted during the dinner-hour.

At 1.25 the lower deck is cleared up, and at 1.30 the watch or both watches are fallen in, and the instructions, exercises, and jobs of work detailed as in the forenoon. At 3 the watch fall in, and again shift a sail or spar. At 3.50 the upper yard men going aloft fall in, and at 4 o'clock the evening evolution is performed, which consists of sending down that which is to be replaced the following morning, and here it will be observed there is a considerable difference between the sea and harbour routine, for at sea the decks are cleared up, and the watch below shift into night clothing at 3.45, the remainder shift into night clothing at 4, and go to supper at a quarter-past; evening quarters coming after supper, and then *every* evening general exercise aloft, shifting spars, sails, &c. In harbour, after inspection at quarters, the cooks repair to the coppers for the tea, and the men shift into night clothing; then supper, and then furl awnings, up ropes and boats, bathe, &c.

At 7.15 in all cases the guard and subordinate officers' hammocks are piped down, and the remainder at 7.30.

Each day concludes with clearing up the decks: in harbour at 8.30 P.M., at sea 8 P.M., after which the Commander goes his rounds to all parts of the ship accompanied by the Marine Officer on duty, the mates of decks, the master-at-arms and corporals, the yeomen of stores attending in their store-rooms, and the engineer on duty in the engine-room. In harbour the ship's company are piped down at 9.30 P.M., but at sea the first watch remain up until relieved at 12 by the middle, which is again relieved at 4 by the men who kept the first, and so on.

The forenoon of Friday is devoted in all cases, sea and harbour, winter and summer, to the very important task of exercising, and, as far as possible, perfecting the preparation of the ship for battle in all its details. On alternate Fridays the preparation aloft takes place as already described, after which the bugle sounds for action without powder, and the whole ship's company to a man are inspected by and drilled under the Captain, then by the Lieutenants in charge of the quarters, and then at boarding, with pikes, cutlasses, &c. In the mean time the fire brigade are exercised, collision mats are got over and placed, damaged rigging secured, &c., &c.; then clean guns.

On Friday afternoon all dirty canvas gear, such as wind-sails, deck clothes, &c., is scrubbed, and the booms are cleaned.

The afternoon of Thursday is, when the service permits, given to the men to make and mend their clothes; and the clothes are washed on Mondays and Thursdays, the hammocks being scrubbed on every alternate Monday.

Saturday is universally devoted to cleaning ships, guns, arms, &c., and polishing up wood and bright work.

The punishments form an important feature. All minor offences have their allotted number of days' black list, which is adjudicated by the Commander, or where none is borne, by the First Lieutenant every morning at 11.30. All serious offences are referred to the Captain, who selects from them those sufficiently so for court-martial. A defaulters' book is kept, in which all offences are registered, and all reports are made through the master-at-arms as head of the police.

The above details may all be considered as coming under the head of routine, but it must not be forgotten that there are elements in the life of a ship which sometimes upset the wisest calculations.

Arrival or departure from port, coaling, provisioning, taking in and discharging powder and shell, docking and undocking, general leave, &c., all more or less interfere with the exact carrying out of the routine laid down, and it can only be looked upon as a general scheme to carry out the interior economy of a ship, subject to the incidents caused by her movements from port to port.

Weighing when moored will usually take, and throw out the routine for, the best part of a forenoon. Coaling with your own ship's company is an evolution of itself, and with 500 or 600 tons to come in, you cannot estimate at a higher rate than from 90 to 100 tons an hour, and after this there is a special cleaning for ship and men. While general leave is going on it is clear that the whole work has to be done with half the men.

Again, at sea the quarter's allowance of powder and projectiles for target practice have to be expended, a portion being fired in each month; this practice culminating in a rivalry between the guns' crews for the first place in prize firing, which takes place annually.

The interior economy of a man-of-war is rigidly inspected by the Admiral in command of the station or fleet at least once a year, and a report of the ship sent in to the Admiralty.

These inspections are not made at any stated times or seasons; in fact, it is not usual to give more than the necessary notice to have the men cleaned in tunics and the books ready, mess-statements, &c.

It would be out of place for me to make any comment on the state of efficiency of the men-of-war of to-day, but I may be allowed to quote the expressed opinion of a writer in the "Nautical Magazine" for July, 1879, with whom I venture to agree: "In most particulars we have enormously raised the standard of efficiency in the Navy. We have introduced system where none existed before, and organization where chaos reigned hitherto. Taken as units of our force it would be, perhaps, difficult to surpass the efficient state of our individual ships even in the future; in the past it has certainly never been

equalled." One thing is clear, that the one great blot of waiting for your ship's company to join is a thing of the past.

It is no exaggeration to say that in the present organization for manning the Navy you can embark a ship's company in the forenoon, give them bags, hammocks, messes, and numbers on the watch-bill, and go to dinner at 12 o'clock, exercise at fire quarters in the afternoon, and give special and privileged leave at 4 P.M., and the ship starts at nearly the same stage as would have been arrived at half a century ago after a year's commission.

I have given the detail for a fleet ship, but the same rules govern, and the same drills and exercises are carried on in all men-of-war, toned down and varied to suit the rigour of the climate or the service on which a particular ship may be from time to time employed.

Leave is an important feature which is worthy of notice. Leave is an indulgence at first open to all. There are three classes, special, privileged, and general, 1st, 2nd, and 3rd. The first go whenever the Officers go, the 2nd when it is convenient to send them, and the 3rd once a month when the service or nature of the port visited permits.

Those who know how to look after themselves remain special leave men all the commission. Those who are not so careful proceed through the privileged to the general, where they remain until six months clear.

There is a class for habitual leave breakers, where the few incorrigible finally gravitate, the only rule for them being that they are allowed out of the ship once in three months. Besides leave, volunteers are always encouraged to go away pulling in the boats of the ship round a marked course, and in fleets, periodical regattas and field sports are organized.

Monthly advances are made to the men of nearly the whole of their pay, which they can allot or remit at will.

What a contrast to the past! Let us, for one moment, go back fifty years—listen to a description of the then state of things: "Kept for years on foreign stations, debarred the shore, and frequently and for long periods without a penny in their pockets, landing in England with fifty, sixty, or seventy pounds, with twenty-four hours to spend it in!!! Surrounded by the profligacy of our seaport towns, and enticed to the commission of every excess, assailed by every temptation, inflamed with liquor, and looking forward to another long absence and a similar confinement. What can be expected but a reckless indifference to conduct?"

Let us be thankful that the glaring errors of the past have been rectified, and let us redouble our efforts so that the future may prove an equal improvement on the present.

FUTURE.

Having endeavoured to make some comparison between the past and the present, we come to the question of the future, and it may briefly be stated as follows: is it likely that we shall ever be able to do away with all sail power, root and branch, or is it more probable

that sailing cruizers and masted vessels will take us through the next century? and their corollaries—shall we have to do away with the gymnasium, *i.e.*, sail drill, mental and muscular exercise combined for the Officers and men—which, in my humble estimation, is the making of our ships' companies, and imparts to them a healthy tone, morally and physically, or shall we seek for a substitute? It will need but little word-painting to picture what a dog's life it would be on board a ship with no exercise: a substitute therefor we must have if large bodies of men are to be confined on board ship. It may be that it will be necessary to seek for it under the form of systematic wholesome recreation, but have it in some form or another we must.

We have not far to seek in the reports of many scientific medical men for opinions on the value of mental action during muscular exercise. It is a recognized fact that without a mental stimulus muscular exercise is of little use to the healthy development of the body, and not only so but the capacity for sustaining fatigue during such exercise is far greater where the mind is employed equally with the body. These conditions are best complied with in the case of fleet exercise, where ships join in friendly rivalry for the first place, or in mast against mast in a single ship.

It has been remarked by Andrew Coombe, M.D., the talented author of the principles of physiology applied to the preservation of health, and to the improvement of physical and mental education, "that exercise should always spring from, and be continued under, the influence of an active and harmonious, nervous, and mental stimulus," again the very conditions which govern drill aloft.

This recognized authority carries out his reasoning on lines which would almost appear to have been written for the special benefit of this question. He tells us that the simple fact that the muscles are expressly constructed for the purpose of fulfilling the commands of the will, might of itself lead to the inference that a healthy mental stimulus ought to be considered an essential condition or accompaniment of exercise; and accordingly the muscular action becomes easy and pleasant under the influence of mental excitement, and a vigorous nervous impulse is useful in sustaining and directing it. On the other hand, how difficult, wearisome, and inefficient muscular contraction becomes when the mind, which directs it, is languid or absorbed by other employments. We see this principle established in every-day sports—a sportsman after game who is getting a fair bag will shoot on till he drops—through turnips and over ploughed fields, where the same man could not do half the distance along a high road with no object.

The same phenomenon is illustrated in cricket, football, dancing, and particularly in fleet exercises. Facts illustrative of the beneficial influence of a mental stimulus as the only legitimate source of muscular activity, abound everywhere, and must be familiar to every reflecting mind.

Those who can call to mind the line of battle squadron in the Mediterranean twenty years ago, when the efficiency and rivalry reached a point which it is doubtful will ever be surpassed—when a

ropes-end down the main hatchway brought all hands on deck—and the signalman of the watch cleared lower deck because he fancied the Flag Lieutenant was a little fidgety on the poop of the flag-ship—will remember the elastic spring, the bright eye, the cheerful glow of beings thus excited, and will be able to contrast them in their mind with the spiritless and inanimate aspect of the ship's company of a mastless ironclad with but little drill and no competitive exercise.

The same important principle was implied in the advice which the "Spectator" tells us was given by a physician to one of the Eastern kings, when he brought him a racket, and told him that the remedy was concealed in the handle, and could act upon him only by passing into the palms of the hands when engaged in playing with it; and that, as soon as perspiration was induced, he might desist for a time, as that would be a proof of the medicine being received into the general system. The effect we are told was marvellous! The story of an Englishman who conceived himself so ill as to be unable to stir, but who was prevailed upon by his medical advisers to go down from London to consult an eminent physician in Inverness who did not exist, may serve as another illustration. The stimulus of expecting the means of cure from the northern luminary was sufficient to enable the patient not only to bear, but to reap benefit from, the exertion of making the journey down, and his wrath at being tricked sustained him in returning, so that on his arrival home he was nearly cured. Nature will not be cheated! and the healthful results of complete cheerful exertion will never be obtained where the nervous impulse, which animates the muscles, is denied.

The force exerted by strong muscles, animated by strong nervous impulse or will, is prodigiously greater than when the impulse is weak or discordant, and man has ever excelled most where he has followed this law of nature.

It thus becomes a matter for serious consideration and discussion, as to what form the exercise of the future is to take. The elements required are plain enough—"practical utility combined with innocent entertainment." How are we to apply them?

Again, although the doctrine of finality has not yet been arrived at, the lasting power of ships is attracting attention. The "Himalaya," for instance, is not a bad specimen of mileage done by one ship. And the, I may say, wonderful result of the suggestion of the Boiler Committee, "to prevent or neutralize the corrosion attributed to the presence of air, by the application of zinc when the boiler is full, and coke and lime when empty, leads us confidently to assume that the durability of the boilers will be considerably augmented, and may possibly rival the lasting powers of the ships."

Now, take in conjunction with these very satisfactory increases in the longevity of ships and boilers, the gradual yet certain increase of docking power all over the world; and we may venture to predict, with some degree of accuracy, the recommissioning of the future. Already recommissioning ships abroad is an ordinary circumstance. How much more so, when you get ships that will last half a century and can be docked on their stations.

So that it is probable that circulation ships for carrying out relief crews, and bringing home relieved crews, time-expired men, invalids, &c., will become a standard element in naval equipment.

In a recent essay written in competition for the Gold Medal of this Institution, I drew out a scheme for carrying out this duty. The important point which connects that scheme with this paper is the preliminary training which all crews would get on the outward voyage in practical seamanship and supplementary training on the homeward voyage. I would thus suggest a point for discussion as follows:—“The tendency being to build for war purposes mastless turret-vessels, and it being possible and most desirable that they may remain on their stations for a number of years, that it is desirable to establish a system of training circulation ships in order to train in practical seamanship while carrying relief crews.”

It may be urged that the stations near home, such as the Mediterranean and West Indies, would not benefit equally with Australia, China, and the Pacific. But that could easily be arranged by starting the circulator three or even six months before the date of relief, sending her in the case of the Mediterranean to the Azores, Madeira, Gibraltar, calling at all ports to Barcelona, crossing to Algiers, and eventually reaching Malta.

In the case of the West Indies, what better training ground could we have than would be found in a sailing cruise *viâ* Madiera to Barbadoes or Trinidad, and then calling at all islands to Bermuda, Halifax, or wherever she was wanted, delivering her men with at least some practical experience of the art of handling a vessel under sail?

From want of space, I have been unable to open up the questions of the numerical strength and duties of our ships' companies of the future; and I may state that I do not see any reason why we should predict any radical change, except in matters of detail, in the immediate future. But I think it would be an interesting feature in the discussion. With regard to the numerical strength of the crews of the future, we had two very decided opposite opinions on Wednesday last at the discussion on the *personnel*. Captain Noel, R.N., said, “that we had not enough men in our ships of war,” and Sir Michael Seymour mentioned “that we had as many as they could stow.” . . .

It is a question of some importance as to whether machinery in ships is to take the place of manual labour. There is no doubt that a great deal that is now done by the men might equally well be done by steam power, compressed air, &c., and at a cheaper rate. But there are the disadvantages of loss of training and the placing of a still greater barrier between the mastless ironclad and the cruiser class, besides the loss of the power of “landing brigades,” forming boat attacks, &c. There is no doubt that the use of machinery is increasing, though I am happy to say not from the same cause as with the Romans—namely, the want of men. Vegetus tells us, “the use of machines in the field” gradually became more prevalent in proportion as personal valour and military skill declined with the Roman Empire; when men were no longer found, their place was supplied by

machines. Let us hope that the application of those words to this country may be long deferred. Nevertheless, let us bear them in mind as a warning.

The development of sub-aqueous or ærial machines, in their relations to the fighting powers of ships, is a study of itself; but I do not apprehend that it will make any radical change in the interior economy.

Notwithstanding one or two expressions which have fallen, both here and in another place, relative to the extreme polishing up which goes on in the Navy, I venture to hope that the men-of-war of the future may be as famed for "That brightness which obtrudes itself upon the eye," as those of the present and past, always bearing in mind that it is the unity of the whole which is so commendable, and that it is no use to brighten up a part unless you work up all the other parts to match. The increase of intelligence and order, and the decrease of crime and its punishment, are surely making themselves felt, and the result is, as it ever must be, increased happiness and comfort.

I have not gone into any detail of the actual fighting of a man-of-war, as that would form a subject for a paper of itself. The following lines will perhaps give some idea of the constant battle which is going on in all ships:—

The absence of an actual fight may seem a sad omission,
 But there is a battle going on in every ship's commission.
 When first the pendant flies, the battle is begun,
 To be renewed, from day to day, beneath each morning sun.
 Steadily and hopefully, a hard fight all the time,
 Our enemy is laziness, our greatest fear is crime.
 Our object that when other ships should dare with us compete,
 To make the ship in which we serve the first of all the fleet!
 As kings in bygone days led on their royal guards,
 So we begin our battle by crossing royal yards,
 And if we don't at first succeed, must try, and try again,
 Until the yards shall seem to fly, on mizen, fore, and main.
 And as they trod their fallen foes, without a single check,
 So we must send down upper yards, and land the masts on deck,
 In general exercise aloft, beat everything that floats,
 Be No. 1 in shifting jib and hoisting out the boats.
 In laying out stream anchor, with all its weight of cable,
 Our watchword is to other ships, beat us if you are able;
 But we must look to everything, commencing with the spanker,
 And crossing over all mastheads, be getting up the anchor;
 Though here we have a friend, whose Christian name is steam—
 A trusty horse who works away, and never tired does seem,
 And as the capstan turns, he gives a sort of cackle,
 Just as if he wished to say, "There goes another shackle."
 Enough of this, there's something more, by which our hopes are buoyed,
 We serve a glorious country, by whom we are employed.
 Remember that Britannia's flag is floating from our peak,
 Remember that in danger, they're sure our aid to seek!
 Remember Nelson's victories, remember Nelson's fame,
 And let us strive to do our best, that we may win the same.
 And of one thing be sure, wherever you may be,
 The cleanest and the smartest ships are happiest on the sea.

APPENDIX.

HARBOUR ROUTINE.

A.M. SUMMER.

4.40—Call boatswain's mates, corporals, and mates of decks.

4.45—Hands.

4.50—Hands fall in, scrub upper deck.

Duty boats' crews clean out.

5.45—Hammock stowers, royal yardmen, and boys lash up and stow, royal yardmen clean conductors, spread awnings.

6.0—Lash up and stow.

6.10—Steerage hammock men, watch below fall in, sound reveille.

6.15—Cooks, up guard and steerage hammocks, bathe.

6.30—Breakfast.

7.0—Forenoon watch to clean in blue working dress, duty men and boats' crews in rig of the day. Watch below clean main deck and flats.

7.15—Watch and duty boats' crews fall in, clean bright work, if top-gallant masts are down overhaul top-gallant rigging.

7.50—Upper yardmen fall in, up all wet deck clothes.

8.0—Evolution, then quarters clean guns.

8.35—Mondays and Wednesdays clean pump gear.

8.50—Return rags.

8.55—Disperse, hands to clean.

9.10—Roll, sweepers.

9.20—Quarters, prayers.

9.45—Watch drill.

10.0—Drills as ordered.

11.0—Cooks, watch below, up spirits.

11.30—Clear up decks.

12.0—Dinner.

P.M.

1.25—Roll, sweepers.

1.30—Watch fall in.

3.0—Watch drill.

3.50—Upper yardmen fall in.

4.0—Evolution, quarters.

4.15—Cooks, shift into night clothing.

4.30—Supper.

5.0—Both watches fall in, furl awnings, coil up ropes.

5.30—Bathe, up boats not required.

7.10—Steerage hammock men fall in.

7.15—Stand by guard and steerage hammocks.

7.30—Stand by hammocks.

8.30—Clear up main deck.

9.0—Out pipes, rounds.

9.30—Pipe down.

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A.M. WINTER.

5.10—Call boatswain's mates, corporals, and mates of decks.

5.15—Lash up and stow.

5.30—Cooks.

5.45—Breakfast.

6.15—Hands to clean in blue working rig.

6.25—Both watches fall in, clean upper deck, upper yardmen clean lightning conductors, duty boats' crew clean out, up guard and steerage hammocks.

7.0—Watch below clean main deck and flats, watch dry upper deck, coil down ropes.

7.15—Overhaul top-gallant rigging if top-gallant masts are down.

7.50—Upper yardmen fall in.

8.0—Evolution, then quarters, clean guns.

8.35—Clean arms Tuesdays and Thursdays, clean pump gear Mondays and Wednesdays.

8.50—Return arms or rags.

8.55—Hands to clean.

9.10—Roll, sweepers.

9.15—Quarters.

9.45—Watch drill.

10.0—Watch fall in, drills as ordered.

11.0—Cooks, watch below, up spirits.

11.30—Clear up decks.

12.0—Dinner.

P.M.

1.15—Roll, sweepers.

1.20—Watch fall in.

3.0—Watch drill.

3.50—Upper yardmen fall in.

4.0—Evolution, quarters, coil up ropes.

4.30—Cooks.

4.45—Supper.

TUESDAY AND THURSDAY.

Routine for Small Arms.

A.M.

8.40—Return rags.

8.45—Hands to clean.

9.0—Clean arms.

9.10—Roll, sweepers.

9.15—G. put belts or return arms.

9.20—Quarters.

FRIDAY.

A quarter of an hour is to be given for cleaning guns, then pump gear. Clean guns after quarters.

SUNDAYS.

SUMMER AND WINTER.

A.M.

5.30—Lash up and stow.

5.45—Cooks.

6.0—Breakfast.

6.25—Steerage hammock men fall in.
Reveille.

6.30—Up guard and steerage hammocks, hands to clean in blue working rig, duty men in rig of the day.

6.45—Watch below clean main deck, watch fall in, clean upper deck as ordered, then wood and bright work, duty boats' crews lower and clean out.

7.30—Duty boats' crews to clean.

A.M.

7.50—Quarters, clean guns.

8.30—Disperse, hands to clean.

8.50—Roll, watch fall in, clear up decks for divisions.

9.30—Divisions, divine service.

P.M.

3.50—Roll, sweepers.

4.0—Quarters.

4.15—Cook's hands shift into night clothing.

4.30—Supper.

5.0—Coil up ropes.

If awnings are to be spread lash up at 5.15, spread awning at 5.30, furl at 5 P.M.

SEA ROUTINE.

SUMMER.

- A.M.
- 3.30—Coil up ropes.
- 4.0—Scrub decks.
- 5.45—Re-set sails, &c.
- 6.0—Spread awnings, hammock stowers, royal yardmen, and boys lash up.
- 6.15—Lash up and stow, royal yardmen clean lightning conductors.
- 6.25—Steerage hammock men fall in.
- 6.30—Reveille, cooks, up guard and steerage hammocks.
- 6.45—Breakfast.
- 7.15—Watch below clean lower deck, watch clean in blue working dress, duty men in rig of the day.
- 7.30—Watch fall in, stations, clean bright work.
- 8.0—Quarters, clean guns.
- 8.30—Clean pump gear on Mondays and Wednesdays.
- 8.40—Return rags.
- 8.45—Disperse, hands to clean.
- 8.55—Roll, sweepers.
- 9.0—Quarters, prayers.
- 9.30—Watch drill.
- 9.45—Drills as ordered.
- 1.30—Clear up decks.
- 12.0—Dinner.
- P.M.
- 1.25—Roll, sweepers.
- 1.30—Watch fall in, drills as ordered.
- 3.0—Watch drill.
- 3.45—Clear up decks, watch below shift into night clothing.
- 4.0—Cooks, shift into night clothing.
- 4.15—Supper.
- 4.45—Roll, both watches furl awnings.
- 5.0—Quarters, evolution.
- 7.10—Steerage hammock men fall in.
- 7.15—Down guard and steerage hammocks.
- 7.30—Stand by hammocks.
- 8.30—Rounds.

WINTER.

- A.M.
- 3.30—Coil up ropes.
- 4.0—Scrub decks.
- 6.0—Hammock stowers, royal yardmen, and boys lash up.
- 6.15—Lash up and stow.
- 6.25—Steerage hammock men fall in.
- 6.30—Reveille, cooks, up guard and steerage hammocks.
- 6.45—Breakfast.
- 7.15—Watch below clean lower deck, watch clean in blue working dress, duty men in rig of the day.
- 7.30—Watch fall in, re-set sails, clean wood and bright work.
- 8.0—Quarters, clean guns.
- 8.25—Clean arms.
- 8.35—Return rags.
- 8.40—Dispense, hands to clean.
- 8.50—Roll, sweepers.
- 9.0—Quarters, prayers.
- 9.30—Watch drill.
- 9.45—Drills as ordered.
- 11.30—Clear up decks.
- 12.0—Dinner.
- P.M.
- 1.15—Roll, sweepers.
- 1.20—Watch fall in, drills as ordered.
- 3.0—Watch drill.
- 3.30—Shift into night clothing.
- 3.50—Roll, sweepers.
- 4.0—Quarters, evolution, cooks, supper.
- 7.10—Steerage hammock men fall in.
- 7.15—Down guard and steerage hammocks.
- 7.30—Stand by hammocks.
- 8.30—Rounds.

TUESDAY AND THURSDAY.

Routine for Small Arms.

- A.M.
- 8.25—Return rags.
- 8.30—Hands to clean.
- 8.45—Clean arms.
- 8.50—G. put belts or return arms.
- 8.55—Roll, sweepers.
- 9.0—Quarters.

FRIDAY.

A quarter of an hour only to clean guns, then pump gear. Clean guns after.

WEEKLY ROUTINE.

MONDAY.

- Air bedding.
- 8.0—Cross upper yards.
- 9.0—Lash up or inspect bedding.
- 9.45—General exercise aloft.
- 3.0—Watch drill.
- 4.0—Down royal yards, evening quarters, wash clothes, alternate weeks scrub hammocks.

TUESDAY.

- 5.30—Lash up and stow.
- 5.45—Up, scrub hammocks.
- 6.0—Spread awnings.
- 8.0—Cross royal yards.
- 9.45—Watch drill.
- 4.0—Down top-gallant masts, evening quarters.

WEDNESDAY.

- 7.15—Overhaul top-gallant rigging.
- 8.0—Cross royal yards, loose sails.
- 9.45—Watch drill.
- 11.15—Furl sails.
- 3.0—Watch drill.
- 4.0—Down top-gallant masts, evening quarters.

THURSDAY.

- 7.15—Overhaul top-gallant rigging.
- 8.0—Cross royal yards.
- 9.30—Landing party.
- 10.15—Marines.
- 11.15—Furl sails.
- 4.0—Down royal yards, evening quarters, wash clothes.

FRIDAY.

- 7.15—Cross royal yards.
- 8.0—Prepare for action.
- 9.45—General quarters.
- 11.15—Cross royal yards, down upper yards.
- P.M.—Scrub canvas gear, up yards, &c.

SATURDAY.

- 3.0—Up, clean hammocks, alternate weeks.
- 4.0—Mend furl of sails, evening quarters.

NOTE:—On Tuesdays in Winter.

- 6.25—Up, scrub hammocks.

Vice-Admiral LUARD, C.B.: I feel that I ought to apologize for beginning this discussion; but if I might venture to make a suggestion to the very able and painstaking author of this paper, it is that he should insert a single word in the paragraph in which he says, "The interior economy of a man-of-war must always be first considered with reference to rendering the ship a perfect fighting machine; next, as to the safety; and, lastly, as to the cleanliness, preservation, and outward appearance of the ship." I would suggest that before "cleanliness" the word "health" should be added, for Lieutenant Campbell has omitted in those remarks upon the interior economy of a man-of-war all reference to the medical staff, whose duties are certainly not unimportant.¹ Those few lines from the old Regulations of 1815, viz., "As cleanliness, dryness, and good air are essentially necessary to health, the Captain is to exert his utmost endeavour to obtain them for the ship's company in as great a degree as possible," are as applicable now as when they were issued, and the medical staff on board a man-of-war can always exercise a beneficial influence upon the health of the ship's company. Two rather remarkable instances occur to my mind. One was the case of a frigate in the River Plate, where there was a great deal of rough boat work. The boats' crews were constantly coming on board wet; and if the Commanding Officer did not give at once directions for the boat's crew to be shifted into dry clothing, the Surgeon made it his business in as respectful a way as possible to remind him that it was necessary that this should be done. The result was that we had less rheumatism, and the cases were far milder than those occurring in other ships employed on the same duty at the same time. Another case was that of a frigate carrying the Admiral's flag at Rio, where there happened to be a very serious outbreak of yellow fever. There were several hundred ships in the harbour—men-of-war and merchant ships; and, I believe, not a single ship except our own escaped. Some of the crews of these ships were indeed almost decimated, and our escape was attributed, humanly speaking, to the fact that very great pains were taken to keep the decks of the ship as dry as possible: in fact, the lower deck of the ship was not wetted for months together, and at the end of that time it was perfectly clean—cleaner, I believe, than if it had been wetted the whole time. These are two instances occurring to me at this moment, in which the medical Officers of the ship intervened in a way which perhaps they might not be compelled to do, but which their anxiety for the good of the public service induced them to do, and with very great success.

Sir F. NICOLSON: How was the deck cleaned?

Admiral LUARD: With dry holystone. The fighting capacity of a ship's company, of course, must depend upon their state of health and general physique; and these are points which the medical staff of the ship should have specially under their supervision. I therefore think that in a comprehensive review, such as this, of the interior economy of a man-of-war, we must not altogether lose sight of the part which is played in it by the medical staff. The suggestions of Lieutenant Campbell to provide a substitute for the healthy stimulus of exercise aloft, in mastless iron-clads, are very valuable, and deserve to be further developed. No doubt some such substitute must be found; and let me say, in the words of the essay which carried off the Gold Medal, we must endeavour as far as possible to reconcile the traditions of the past with the requirements of to-day.

Colonel MALCOLM GREEN, C.B.: I should like to ask the lecturer to give us some explanation as to the duties and responsibilities of the Navigating Officer: I do not exactly understand what his responsibilities are.

Captain J. C. R. COLOMB: I should be very sorry if this paper were dismissed with the slight discussion we have had upon it; because it is a very interesting paper, and it conveys a great deal of information. It also deals with questions that are now coming every day before the Navy, especially with regard to the future. I feel a great hesitation in troubling you again, considering that I have spoken so recently; but my object in making a few observations is to start a further discussion. All who do not know what a ship of war is, and indeed who do know,

¹ Paragraphs on the Medical and Paymasters' Staff have been subsequently added to the paper.

must feel greatly indebted to the lecturer for giving us in a convenient and pithy form the salient features of the interior economy of a ship of war of the past. In the first page, the author says that we have, on the one hand, mastless turret-ships, and that we are in a stage of change. That is undoubtedly true; but while the ships are changing, our plan seems to be not to change our naval organization, so as to adapt it to the ships. There is one question I should like to ask the lecturer with reference to the passage in his lecture, in which he says, speaking of the past "that many ships are reported to have arrived at a high standard of efficiency is due more to the Officers who commanded them than to any general system of organization or training." I would ask him, is not this statement as applicable to the present as to the past? In the passage in which he says, "With reference to the clothing and personal cleanliness of the men and their conduct at gun and sail drill, the Lieutenants are responsible through the Commander to the Captain," &c., Lieutenant Campbell here omits altogether any information about how the finance arrangements of the men are carried out. I think that is a very important matter, considering the very large sum which the Paymaster class costs. He says that the Lieutenants of division really have only to do with the clothing and personal cleanliness of the men. I have for many years held the opinion that a proper organization would, by a subdivision of labour connected with men's accounts, enable the Officers of division to do what is done in the Army—to deal largely with the pay arrangements of their divisions, and thus you would get rid of an Officer of the Paymaster class on board ships at a high salary, substituting combatant Officers with a little increased pay, as in the Army. That, I think, is a most important matter for discussion with regard to the interior economy of a ship. You have not too much room for Officers; you have only enough to fight the ship; and if one or two Officers are killed, you must be short and hard put to it. In the meantime, you have the Paymaster at high pay, taking the position of a combatant Officer. The question arises, whether by improving the organization of the Navy, you could not get more economy and increase the fighting power, besides bringing the Officers more in contact with the private characters of the men, which is a material point; and there is nothing where the private character of a man comes in so much as when you begin to deal with matters relating to his pocket. Then there is another point to which I should like to refer, and in regard to which there is a wide difference between the Navy and the Army. In the Navy your organization is not so complete, for this reason: your chain of responsibility is not perfect. For example, in the Army, the gradation of the punishment that an Officer can award descends with the rank of the Officer. You observe here that it is the Captain or the next in command who alone has anything to do with the punishment of the men. Now, the question is, whether, in the distribution of power of punishment, the chain of responsibility might not be better maintained by following somewhat in the same direction; so that for minor punishments, within certain limits, an Officer of division may exercise authority, higher offences going to the Commander, and still higher to the Captain. With regard to the petty officers in a ship—I am speaking from past experience, not having served in a man-of-war for many years—I know there is a vast difference between the reliability, in matters of discipline, of petty officers as compared with non-commissioned officers, and that a good deal arises from the necessities of a ship. I do not think that the petty officers on board a ship are made so material and important a link in the chain of responsibility as is necessary to keep up the real chain of discipline. Any improvement which can be effected in that respect, I think, would be advantageous. Then with regard to the Artillery and the Marine Infantry forming a proportion of a ship's complement, I admit that it was a necessity in the past; but I doubt whether it is at present. If it is a present necessity, I think it is because the country denies to the Navy the means and opportunities of that organization which would render it so far self-reliant as to be able, in ordinary times of peace, to do without a force on board ship which is wholly auxiliary, but actually kept serving in peace as an integral portion of the Navy afloat. As I said the other day, for every marine and artilleryman you keep three years on board ship, you are keeping probably a boy or an ordinary seaman three years in a harbour-hulk to learn the duties of a seaman there, because you cannot put him in a ship; there is no room for him. With

regard to Officers, I repeat what I have so often said, that I consider it is an enormous waste of money to educate Marine Officers and Artillery Officers to take up room on board ship doing practically nothing.

Rear-Admiral HORTON, C.B. : I should like to allude to one point mentioned by Lieutenant Campbell with regard to the future. I may be permitted to observe that the importance of the "circulating system" appears to me to be very great, and my principal reason for rising is to say that during the twenty years I have had nothing to do afloat, it did occur to me to suggest to the Admiralty that a system of circulating cruizers should be established, leaving this country at certain regular intervals, so as to enable the ships (that should be sent round the world) to visit the different stations, and to be there at certain points ready as reinforcements for any service that might unexpectedly occur, and to return home, bringing with them invalids or returned crews, very much upon the plan that Lieutenant Campbell has now proposed :—that such ships should be sent with the definite object of relieving the crews and training them in seamanship on the voyage. I would venture to suggest to Lieutenant Campbell, that if he endeavours to mature his plan at any future time, *two* ships should be sent together, and, if possible, two exactly alike, the better to provide for any accident happening to any part of the machinery, spars, or sailing gear of either. I think by that addition to the plan suggested by Lieutenant Campbell, an important element would be introduced into the Service, fulfilling many duties that are now required and would be further required with the revival of sailing in prospect, enabling the ships to be ready at the different stations at specified periods to act as a reinforcement under the Commander-in-Chief of each foreign station.

Lieutenant CAMPBELL : Admiral Luard referred in his remarks to my omission of the medical staff. That omission did not arise from my not thinking of them or my not appreciating their great usefulness on board ship. I thought that by the rules of the Institution I was limited to an hour for delivery, and to sixteen pages of the Journal, so after I had written my paper I had to cut out a great deal before putting it before you, so that I am afraid it has been placed before the Institution in not so full a condition as I should have wished. I had to leave out reference to Paymasters, medical Officers, and all except the executive Officers ; and I hope that they will accept my apology for the omission. A question has been raised by Colonel Green with reference to the responsibility of the Navigating Officer. I suppose he means as between the Navigating Officer and the Captain ? I am sure that every naval Officer present knows that that is about as difficult a question as can be asked at the present time, and I certainly would not take upon myself to answer it, except as an individual. I will give you my own idea of the matter, and give a short anecdote in illustration. I said in my paper that the Captain is responsible for all ; and when I said it I meant it. In a ship of war the Captain is responsible for everything that has to do with her ; either with regard to her movements from port to port, or to the interior economy of the ship, he is responsible and he alone. The Navigating Officer is responsible for the navigation of the ship under the Captain. There is a story of a ship going to Bermuda Dock, the Captain and the Navigating Officer of which, apparently, divided the responsibility between them. The Captain said, "It is a very narrow passage. I will take charge of the starboard side of the ship, and you can look out for the port side." When the Captain saw that his side was getting a little too close he ported his helm, got into a position where he had plenty of room, and said to the master, "I am all right on my side." "I am ashore mine!" said the master. So that the Captain looking after one side, and the master the other, the ship was grounded. I believe, with Captain Colomb, and I stated in my essay on "Training," that the time has come when Lieutenants can assist in financial matters ; but not in addition to their other duties. With reference to fighting, every day that passes we find more and more that you want a whole heap of Officers who will be ready to take command immediately. The betting is very heavy—100 to 1—that the Captain will be killed on first going into action, and that the Officers relieving him will be killed in their turn.

¹ See Journal R.U.S.I., vol. xxvi, 2nd Essay, p. 250.

For that reason I believe in every Officer being a combatant Officer, thoroughly trained in tactics, and capable of taking command of one of Her Majesty's iron-clads in a fleet action. That of course we know Paymasters and other Officers not combatant are not supposed to be capable of doing. I beg to thank you very much for the kind attention you have given to the paper which I have done myself the honour of reading to-day.

Sir F. NICOLSON: I should like to say one word in explanation of what Lieutenant Campbell has said with regard to the length of his paper. I do not think he occupied forty minutes in reading it, so that he still had a quarter of an hour to spare, and we are always disposed to allow a certain latitude, especially for valuable papers like his.

The CHAIRMAN: In proposing a vote of thanks to the Officer who has given us this very valuable paper, I may be permitted to make one or two remarks. I think that he has lost sight of one fact, viz., that in future in case of a naval war (which is, after all, what we must think of) we should not have altogether to deal with a continuous service of men and boys. The present number of men and boys is very limited, and in the event of a war we should have to man a great number of ships with recruits, and consequently our time would be very much more taken up than it is at present in drilling novices at great gun and other exercises. At the same time I would not for a single moment wish to throw a damper upon drilling aloft. I have often heard the remark, "What is the good of your reefing and furling sails or sending down a mast or yards, when in action in the future you will have mastless ships?" I think that is a very great mistake. Our masts and yards are, to all intents and purposes, a gymnasium for making our men muscular, and active and ready of resource, in fact to be, what I hope they are, British sailors. There was one remark made by Captain Colomb which I certainly did not expect to hear from him, and which I strongly object to. I do not think the time has arrived, and I do not think the time will arrive in the future, when we can do away with our marines and marine artillerymen.

Captain COLOMB: I did not say I would do away with them.

The CHAIRMAN: I understood you said they took up the place of other men. I should like to put on record that I most strongly feel that the time has not arrived when we can do away with all our marines. They are a very excellent body of men on board a man-of-war; everybody must do his own work. The old saying is true: "Everyone to his work, and the cook to the foresheet." The happiest ship will be the one where everyone does his own work; where the Captain exercises a wholesome influence over everybody, but does not take a bit of the boat-swain's work, and a bit of the Commander's work, or the Marine Officer's; he simply sees that all under him do their duty. I beg now to propose a vote of thanks for the admirable paper which Lieutenant Campbell has given us, and to say how satisfied we ought to be, especially the older members of the profession, that those who are younger than ourselves are showing such aptitude in making themselves and others acquainted with the everyday routine of a profession which, without any derogation to the Army, is, after all, the mainstay of the British nation.

Wednesday, June 21, 1882.

CAPTAIN P. H. COLOMB, R.N. (Commanding Steam Reserve,
Portsmouth), in the Chair.

THE NECESSITY OF SUPPLEMENTING ARMOUR-CLAD SHIPS BY VESSELS OF OTHER TYPES.

By CAPTAIN R. H. HARRIS, R.N.

MR. CHAIRMAN AND GENTLEMEN,—In availing myself of the privilege of addressing you this afternoon, on the necessity of supplementing armour-clad ships by vessels of other types, my object in so doing is not so much to enunciate my own particular views, as to provoke a discussion in this Institution, on the merits and demerits of our armour-clad ships, with reference to their capabilities of executing those very important duties, which will most certainly be expected of them, when we next have the misfortune to be involved in a maritime war.

Many persons, whom we cannot do otherwise than consider high authorities on such matters, when expressing their opinions in regard to the best means of adding immediate strength to the Navy, advocate the construction of armour-clad ships of great power; while others, who are also entitled to speak with authority on these subjects, throw the weight of their influence on the side of swift rams, or heavily armed fast gun-vessels. Again, there are people who are inclined to condemn all existing vessels, and construct the most formidable torpedo-vessels, in the belief that they will decide the issue of future naval battles.

Such being the somewhat conflicting opinions with which we have to deal, I do not think any apology on my part will be needful, for endeavouring to bring under your discussion the shortcomings of armour-clads, and introducing with some diffidence my own ideas as to the necessity of supplementing armoured ships by vessels of other types, believing as I do, that it is possible by adding a sufficiency of vessels of other types, in due proportion, to armour-clad ships, squadrons, and fleets, to increase their efficiency to a far greater extent than if the money these supplementary ships would cost was applied to the construction of one or perhaps two additional armour-clads.

To be able properly to approach and open up this subject for discussion, I must ask your indulgence while I make a short digression, which is, I think, necessary to lead up to the very commencement of the question, by, in the first place, determining what is the relative

power of armour-clads in comparison with the ships they have superseded, and with the power of the new forces against which they will have to measure their endurance and strength.

Since the absolute supersession of wooden line-of-battle ships by armour-clad vessels, driven off the face of the ocean as the former have been by the constant and rapid increase of the power of heavy guns, and the destructive shells projected from them, there can be no question but that the conditions of naval warfare have been as distinctly revolutionized as the respective types of war ships, past and present, have themselves changed.

Wonderful indeed have been these changes, and great is the diversity of type amongst the armour-clads themselves; so great indeed is this diversity, and so complex are the conditions which must be fulfilled to satisfy the requirements of perfection in an armour-clad, that it sometimes seems to me probable that these mighty monsters of the deep, which by the united talent and skill of the naval architect, engineer, and mechanic, have been made such splendid illustrations of armed science, were themselves in great measure on the eve of passing away into history, under the never yielding pressure of that relentless spirit of perpetual progress, which is the special feature of this most remarkable nineteenth century.

Nevertheless, the fact remains that we are in the possession of a costly armour-clad fleet, and in the event of war with another naval Power, this fleet will have to pursue, attack, or blockade the armoured vessels of the enemy. If this were all, we might perhaps rest content, well assured of success, but should we not be most imprudent to do so, resting as we should be on an almost untried article, liable to fatal attacks of a novel nature, which will leave the sole point on which the reputation of an armour-clad rests, viz., the immense thickness of armour and general impenetrability, entirely out of the question?

Before going any further with my subject, I must pause for a moment to explain as clearly as I am capable of doing, that, while endeavouring to point out the inefficiency of armour-clad ships, with the intention of demonstrating the fact that they require to be supplemented by other types of vessels, yet at the same time I have not the most remote intention of asserting that our noble armoured vessels are useless, or that any want of discretion, or error in judgment, has been shown in constructing them, or that we have built one too many of them.

On the contrary, I hold that the heavy armour and powerful ordnance which they carry may be on certain occasions of the greatest possible value.

But with your kind permission at this present time, I do wish most emphatically to assert, that the relative powers of the modern armour-clad and of the line-of-battle ship of the past are not, comparatively speaking, in anything like the same proportion, and that the comparison is very unfavourable to the relative power of the armour-clad.

Again, with your leave, it is my desire to add my voice, humble

though it may be, to the voice of those who have of late in this Institution repeatedly called attention to the rapid and startling changes that have taken and are taking place in all the conditions of naval warfare. Yet these changes, extraordinary as they are, seem only partially recognized by the country, and even then only in a general sort of way. Indeed the thought sometimes occurs to me, that we,—the nation whose prosperity, aye, and whose very life, is bound up with the mastery of the seas,—either do not care, or perhaps do not dare as a body to reckon what will in future occur, may be in our naval hour of need. But, instead, we prefer to live on in the vain and delusive hope that if we build as many and no more of the same classes of vessel as a possible enemy, arm them with the same guns, &c., then trust that as occasion may demand, the right men, the right ships, and the right tactics will be forthcoming at the right time, without further effort on our part; unwisely forgetful of the historical fact that although the decadence of the ancient maritime Powers may, perhaps, be traceable to the internal corruption of the nations, yet the departure of their naval supremacy has most usually resulted from the employment of some new type of vessel, or new method of attack, on the part of a rival hostile Power.

Bearing this in mind, I venture to say that, while we depend upon naval supremacy for our existence as a nation, it becomes our imperative duty to carefully examine any probable or prospective change in the conditions of naval warfare, boldly confronting possible changes before they arise, and giving them that serious consideration both in theory and practice which the paramount importance of the results must necessarily deserve, trusting, meanwhile, that our labours may keep us in naval matters far in advance of our possible foes, confident that the change or improvement, either in tactics or type of ship, may be on our side, and that the danger of having to face new ships under different or unknown conditions should rest with the enemy and not with ourselves.

To in some small measure approach this vital question, I must ask you to admit, or perhaps rather allow, for the moment, that our armour-plated ships of the larger types are the actual successors of our glorious old line-of-battle ships. Surely they are constructed to take the place of the latter, and both singly and collectively, in squadrons or in fleets, to fulfil the same functions, do the same duties, to carry our renowned flag, if not quite in the same fashion, at any rate in the same glorious and victorious manner, that their predecessors did in the hands of our forefathers. If we are not prepared to admit this, must we not be in error? For otherwise why should successive Administrations and Parliaments lavish such vast sums from the national purse upon the construction of our steel and iron monsters, were it not expected that they, in the hands of our Admirals and Captains, will maintain that same naval supremacy which has happily so long been the source of the honour and wealth of this country? And, again, if they are not the vessels with which we are to uphold the said supremacy, I ask with confidence what other class of ships have we at this present time in the Royal Navy that are capable of

doing more in time of need than help to protect our huge commerce? Have we any vessels which, independently of armour-clads, are capable of driving our possible foes off the high seas, and then, having done so, securely seal his ships in their ports of refuge? Has not this been done in the past, and will it not have to be done in the future, by that nation who dares assert her supremacy on the ocean?

Admitting, then, that our iron and steel clad vessels of the larger types are the inheritors of the glories and duties of our departed line-of-battle ships, is it not our obvious duty to examine their comparative efficiency and inefficiency for the work required of them?

Where we find efficiency let us gratefully accept the fact, where there is manifest inefficiency let us try and supplement it with the needful coefficient, always remembering that at present one armour-clad will have to take upon herself a far greater work than in the olden days five line-of-battle ships were thought capable of performing.

In support of this assertion, let me quote from the "Naval Chronicle" of 1799, where it gives the strength of the Royal Navy in June, 1798, as follows, viz.:—

Line-of-battle ships	188
Fifties	27
Frigates	217
Sloops	345
Total	<hr/> 777

Thus, in spite of the enormous increase of commerce, and the general increase of our national wealth during the last eighty years, we have now only some forty armour-clads to represent the 215 large and small line-of-battle ships existing at the end of the last century. Such being the case, is it not wise for us to closely inquire into the efficiency of our few armour-clads, and ascertain as best we can if they are able to competently take up the duties of the 215 large vessels of that day, aided as they were by 217 frigates and 345 sloops?

To determine this relative efficiency or inefficiency, it is necessary to speak separately of the merits and demerits of both the old and new types of vessel, and of the work they did and have to do. Granting, for the sake of argument, that what is appropriate to the single vessel will apply with nearly equal force to the squadron or fleet, sometimes with more, sometimes with less exactness, but always applying, we will turn first to the older vessels—the predecessors—now familiarly styled the old wooden line-of-battle ship. What proud confidence is expressed in the term line-of-battle ship! we have now our lines ahead, our bow lines, our quarter lines, our system of groups, but where is our line-of-battle? I fear it has succumbed, like its glorious prototype, to this restless age of steam, of iron and of steel.

Nevertheless, if she and it have succumbed, their glories have not; and history will relate far into the future how, when fairly manned and found, a line-of-battle ship might on her own element proudly and justly assume to herself a certain potency that is impossible to any vessel in the present day. She stood on her own merits, a floating

castle, the positive equal of all vessels not exceeding her in size; no less costly or inferior vessel dare face her gun-power, no submarine mine lurked on hostile coast, no insignificant vessel or torpedo-boat could under cover of night or fog attempt to blow a hole in her bottom; there existed no hostile ram which, under similar conditions, could water-log or sink her.

Uncertain as her motive power was, it was practically inexhaustible, fickle and fluctuating as the winds are, so long as they blew, they favoured friends and foes alike. A fresh supply of provisions and water, with a few days to caulk and refit aloft, put her into thoroughly efficient condition even after the longest of cruises. When at sea, sailing east or west, north or south, increasing or decreasing speed, provided that the limits of her water and provisions were not too closely approached, no vital power was consumed. Her state was one of constant and immediate readiness for instant battle. No inferior enemy dare cross her ocean pathway, smaller foes sighting her, sought safety in flight.

Unsupported by frigate or corvette, sloop or brig, she was the proud and stately equal of any individual foe on the face of the broad seas or narrow waters.

How different is the position of her direct descendants, the large armour-clad vessels of the present day! I would that they possessed a like immunity from peril at the hands of inferior foes. Let me select a ship of the "Colossus" class merely as a fitting representative of a modern armour-clad, embodying as she does nearly all the vaunted ideas and warlike inventions of this eminently scientific age. She too, like her ancient compeer, has a potency of her own, and is capable of taking that potency in a given time and to a great distance with a speed and certainty, which to a line-of-battle ship would be outside the realms of possibility. And she, her coal-power and speed being unimpaired, possesses in an equal and comparative degree the power of fighting a successful action with an enemy of her own class. In like measure, during the daylight and clear weather, most smaller foes would wisely avoid her guns; and it must be freely admitted that, taken separately, all smaller vessels, be they frigates, corvettes, or sloops, if inferior in speed to herself, must become her sure and certain prey, *vide* Lieut. Madan's interesting communication to this Institution concerning the Chilian and Peruvian War, in vol. xxv, No. CXII of the Journal, in which he remarks as the result of his study of the naval operations of those nations, "that nations who choose to build their unarmoured corvettes or sloops with speed inferior to the ironclads of a possible enemy must expect to lose them."

But here I fear favourable comparison ends: every mile she steams, every preparation for action she may make, any vessel she may pursue, all hasten the necessity of a visit from a friendly collier, or a speedy return to a coaling station or port.

On a foreign and hostile coast the deadly submarine mine will lie in her path. There also will be the light and swift torpedo-boat, or a combination of these representing an infinitesimally small cost, both in

men and money, as compared to herself. Vessels confident that they hold, under conditions favourable to themselves, the power to destroy their costly foe, knowing themselves too swift to dread her pursuit, and possibly sure in their own minds that she would not imprudently empty her coal bunkers in a vain chase after them. Thus they might hover on her horizon, and so without making any actual attack, by keeping her in constant preparation for defence, much exhaust her steaming power, a process of exhaustion only to be relieved by her departure from the base of operations of her diminutive foes, or rough weather forcing them temporarily to seek shelter. But not this danger alone: under certain circumstances a determined attack by these small and swift torpedo-boats might, if well organized and made simultaneously by a sufficient number of them, be fatal to any armour-clad afloat even in the daylight.

To go beyond the single armour-clad, let me for a moment attempt to describe roughly the sort of attack to which a squadron of armour-clads cruising off an enemy's coast would be liable, and then ask if there is not the possibility of its being in great measure successful. We will suppose an enterprising determined enemy, commanding a force of some twenty Thornycroft torpedo-boats. He has ascertained (how we need not inquire) the actual force and position of a hostile armoured squadron on some particular night, the weather on the occasion proving favourable to a torpedo attack. He issues orders to his torpedo-boat force somewhat as follows:—"From information I have received, I expect to find an armour-clad squadron of the enemy 50 miles north of Ushant. I contemplate seeking and attacking them about midnight. It is my direction that you are in readiness to proceed in company with me at 8 P.M. You will then weigh in company, and take each other in tow in order of seniority. It is my intention to steer to the north at 12-knot speed. The greatest caution is to be observed with regard to silence, all lights to be most thoroughly concealed and covered. It is my desire that any look-out vessels or guard-boats of the enemy should be most carefully avoided. But should they discover us and action with them be unavoidable, the four sternmost boats will cast off and endeavour at all costs, and regardless of hazard, to sink or capture them, parting company then and there from me, and returning to port at their own discretion.

"On discovering the enemy, you will by my order cast off and, forming line abreast, dash for him at your highest speed, acting independently of me and of each other, using your utmost exertions to successfully fire your torpedoes, which being expended, you will after the attack, having to the best of your ability supported each other, return to port also independently of me."

I pause here to ask if a squadron of armour-clads, when at sea and unaided, are efficient to successfully combat an attack of this nature. Those who know the condition of a squadron on a dark night at sea, and who have seen the uncertainty that ensues when two or three of its ships are thrown out of station, or the watchfulness and caution required during the performance of any manœuvre involving a large alteration of course, can best imagine the effect of twenty swift vessels

approaching, covering the mile that they could be seen, easily under four minutes. I much fear that electric lights, torpedo-nets, machine-guns, heavy armaments, and ponderous steel-faced plates would avail not to save many a torpedo shock, with its consequent destruction or disablement of some costly armour-clad.

Or suppose double the above-mentioned number of torpedo-boats concentrated with the view of attacking an armoured squadron by day, would they not even then be a serious danger?

Independently of these present risks on a hostile coast, signs are not wanting of the speedy introduction of a larger and more formidable class of torpedo-vessels, which, while equally excelling the speed of armour-clads, will be able to keep the sea with equal facility; vessels which will give the greatest scope to the ability of a daring and practical seaman, with good information concerning an armour-clad enemy, and possessing that overwhelming confidence and resolution which usually accompanies those who feel that they have the power of opportune and successful attack in their hands.

Contrast their position with that of an armour-clad foe, who may be either in perilous ignorance of the proximity of such dangerous enemies or harassed by the knowledge that he must await an attack from antagonists whose hand he can never of himself, through lack of speed, hope to force.

In addition to these coasting and sea-going torpedo-vessels, of which great numbers are sure to spring into life during the next great maritime war, it may, I think, be safely predicted that a very swift class of gun-vessel will come into existence, which need not aim at the very extreme speed of the torpedo-vessels, but, while still being constructed to outstrip the speed of armour-clads, will have their speed somewhat subordinated to the power of carrying a long-range gun.

These craft, like the torpedo-vessels, possess, by reason of their speed, the power and advantage of being able to select their own time and method for an attack on armour-clads. When we reflect how large a portion of our latest armoured ships is unarmoured and of the most fragile construction, we can realize that in a game of long shots the lighter, smaller, and least costly craft would not be the only sufferers.

In Sir William Armstrong's address upon our national defences he described some new light gun-vessels, as follows, viz.: "Light unarmoured ships have lately been constructed in this country to the designs of Mr. George Rendel, for foreign Powers, which, with a displacement of 1,300 tons, have a speed of 16 knots, and carry sufficient coal for steaming 4,000 miles; they are each armed with two new type 10-inch guns, capable of penetrating 18 inches of iron armour."

Here we have the beginning of such vessels, which if built to carry only one gun, might have a speed exceeding 16 knots, and thus be far more rapid than any armour-clad can hope to be.

Let us roughly estimate the probabilities of an engagement between a vessel like the "Colossus," and, say, four of these gun-vessels. Beginning with the monetary value, which seems the measure of most

things in the present day, we have here an armour-clad vessel, costing some 500,000*l.*, and with a crew of 400 men, and four vessels costing about 50,000*l.* each, and carrying a complement of 90 men. Then in the event of the "Colossus," by a well-directed fire, sinking one of her small opponents, and causing the others to withdraw, we have to estimate her success in this ratio—one vessel of 50,000*l.* value, manned by less than 100 men, *hors de combat*.

But should the fortune of war turn the other way, and these puny foes, by a few well-directed shells, inflict considerable injury on the weaker portions of their monster enemy, damaging her sufficiently to necessitate her seeking port, a not very improbable circumstance, we may then reckon the loss as 500 men and an engine of war worth half a million of money, rendered for the time unserviceable to the nation, who may have put too much trust in the power of an armour-clad ship.

The above argument would of course equally apply to an action between an armour-clad and gunboats of the well-known "Staunch" class, in so far as the destructive power of guns is concerned; but I would purposely refrain from quoting that class of vessel as any argument against the power of armour-clads, for the obvious reason that the very low speed of these gunboats must render an action with them entirely optional on the part of the armour-clad, while, if cleverly handled, she might, by her superior speed, destroy them one by one.

If any of the foregoing remarks as to the dangerous attacks to which armour-clads are exposed from foes hardly worthy of their supposed prowess be true, or even if they are possible contingencies, can unsupplemented armour-clads be pronounced efficient for our naval requirements? I think not. Then, if they are lacking in efficiency on some points, let us consider what is necessary for us to do, in order to, as far as possible, supplement them.

First and foremost of all supplements, we must arrange for perpetual relays of steam-colliers, some to follow and others to meet the armoured ships at certain specified rendezvous. It will be the imperative duty of an Admiral never to lose an opportunity of keeping each and every ship in his fleet constantly complete with coal.

Next we may take it for granted that it is a necessity to supplement every squadron with a steamer like the "Hecla," fitted to carry Thornycroft torpedo-boats and to be otherwise utilized as a general depôt for submarine mining and countermining stores. Steamers fitted for this service should be fast vessels, with the view of rendering their capture by the enemy improbable.

On foreign service it will also be a needful supplement to have a steamer for use as a factory ship; indeed, it will be generally necessary to supplement any considerable gathering of armour-clads with a steamer for this purpose, wherein large repairs of ironwork, &c., could be effected.

Independently of the above, let us, as a matter of vital importance, attach a co-efficient force in the shape of swift seagoing torpedo and gun-vessels in due proportion to the solitary armour-clad, and in greater numbers to the cruising squadron or fleet of armour-clads.

Construct these vessels to largely exceed their mailed consort in speed and handiness. The proportion attached should not be less than two to each individual armour-clad, and at least three of these swift craft to every two armour-clads composing a squadron.

I do not feel that it is necessary for me in this short paper to go fully into details of these craft; it is more a question for naval architects. We as seamen must state our requirements for the particular class of vessel, and trust to them for the fulfilment of our ideas, only insisting that the maximum speed shall approach 18 knots an hour, and that they shall be seaworthy craft. I hope that by the employment of such vessels we may add that efficiency which is lacking in armour-clads, and which without supplement we cannot hope to restore.

The ordinary war duties of these swift vessels when attached to armour-clads would, in fair weather, be somewhat as follows, viz., some to precede the advance of their armoured consorts, while others should scour the seas on the bow and beam of the formation, overhauling strange vessels and collecting all possible information for the Admiral or senior Officer in command. These duties vigilantly carried out would render a surprise impossible, and the information daily collected might often prove of the greatest importance, while the sea cleared or covered by a fleet proceeding thus guarded, might, during daylight, exceed 25 miles in breadth.

Especially vigilant should these look-out vessels be at sunset, before closing in and taking up their station for the night, while at early sunrise they should spread fanlike to again take up with keenness their reconnoitring duties. Undoubtedly this would entail a considerable expenditure of fuel on the part of these vessels, they would require frequent coaling and occasional relief, but the value of their services would be, I think, quite commensurate with this expenditure, while it would most favourably compare with that of the armour-clads, had they to undertake any of these duties for themselves, to say nothing of the waste due to their monster engines being hourly kept in constant readiness for rapid increase of speed in case of surprise. While if, as before mentioned, swift vessels had searched their course well in advance, and with flanks carefully guarded, they might safely and leisurely proceed with fires low at an economical speed, thus preserving their coal endurance, and consequent efficiency, for a far longer period than otherwise would be possible.

It is hardly within the province of my subject to here go into the question as to what these swift look-out vessels should do on sighting the enemy, mainly depending as it would on the discretion of the Admiral, tempered by the information with which they have supplied him. But we may justly assume that whether employed to drive in or destroy the look-out vessels of the enemy, or ordered to fall back rapidly on their armoured consorts, their presence would be of no small value, even when their all-important look-out duties had terminated.

During the heat of future naval actions many a favourable opportunity will be afforded these vessels of using a torpedo with fatal effect, in the *mêlée* when armour-clad is attacking armour-clad in

deadly combat, when the air is charged with smoke and noise from the furious cannonade of heavy guns, the growling of Nordenfelts, the sharp crack of rifles, mingling with the roaring of escaping steam; amidst such din and confusion, who can over-estimate the value of numerous swift vessels, each capable of wreaking fell destruction on the largest armour-clad?

Not least in importance in the value of small swift vessels when employed as the supplement of armour-clads, will be the power they will give a Commander-in-Chief of rapidly sending his orders, when there is any difficulty in conveying them by signal, a point clearly pointed out by Lieutenant Charles Campbell, R.N., in his very interesting paper "On Signalling and Conveying the Orders of a Commander-in-Chief in Action," recently read in this Institution.¹ His remarks at that time render it unnecessary for me to say much as to the extraordinary value of having swift vessels, wherewith an Admiral could rapidly despatch important orders from ship to ship. At the finish of a hotly contested battle they would be invaluable to pursue and harass the light vessels of the enemy, also to track and mark down an escaping armour-clad foe. One or two swift vessels would be immediately despatched with news of the action to the nearest friendly port, or hurried off with timely warnings in case of a reverse.

During the blockade of a port in which it may be necessary to confine armour-clad enemies, small swift vessels would be of infinite service. Outside the lines of torpedoes they would be employed watching the entrance of the harbour, leaving their armour-clad consorts well out in the offing, beyond the reach of ordinary torpedo-boat sorties at night, sure by day of receiving speedy information of any movement on the part of the enemy.

A blockaded force would also be harassed by the knowledge that all sorties made by them must first evade these swift look-out vessels, and that even if successful in doing so, they must run a dangerous gauntlet when returning to port.

I confidently submit that the blockade of a harbour conducted in this way, viz., by an armour-clad squadron supplemented by swift torpedo and gun-vessels, would be far more effective and much less costly and hazardous, than if an unsupported fleet of armour-clads cruized off the entrance, in the same manner that fleets of their predecessors, the wooden line-of-battle ships, were wont unconcernedly to do.

At the very commencement of a war with any neighbouring Power, and during its continuance, vessels of the above types detached from their armour-clads should be employed to scour the Channel, daily issuing from Dover, Spithead, Portland, Plymouth, and other harbours; in the Mediterranean, in the same way, the daily cruizing of these swift vessels, supplemental to armoured ships, would more effectively establish and hold our naval supremacy in these waters, than the more cumbrous and expensive cruizing of an armour-clad fleet.

By employing swift vessels for this service we should realize the

¹ See Journal, vol. xxvi, No. CXIV.

wonderful factor that high speed will be in all naval operations of the future; these vessels, allowing them only to steam 12 knots when thus employed, are capable, during twelve hours of daylight, of clearing a circle of 144 knots' circumference round their base of operations, or of steaming twice round a circle of 24 miles' diameter during the same time.

It may be urged that many of the duties which I here propose to allot to swift seagoing torpedo and gun-vessels might be undertaken by the torpedo-boats carried by most armour-clads. I am quite willing to admit this to be possible, but it must be done under very exceptional circumstances, such as perfectly smooth water, with convenient shelter near, for which the torpedo-boats could make in the event of sudden bad weather.

However, in any case, the comparatively low speed of these boats, and their inability to take care of themselves if separated from their ships, would prevent their services being so thoroughly reliable as those of larger vessels capable of an independent existence. On many occasions it may easily be conceived that the separation of these craft from their respective ships would be a source of anxiety, rather than a protection, to the Officers commanding the armour-clads to which they belonged.

Some of the above arguments will not hold good if the torpedo-boats were carried by and attached to a special torpedo-ship like the "Hecla," from whom they might probably be more advantageously employed.

Very possibly it may be urged that the look-out and reconnoitring duties before-mentioned might be effectively carried out by our corvettes of the swifter classes; it may be so, but would it not be far more costly? Their consumption of fuel is great if pressed at high speeds, and are we justified in presuming that the services of such vessels could be spared from their more natural duty of protecting our ocean highways; a very improbable contingency if we were at war with an enterprising country?

Without doubt powerful tugs and other similar fast steamers could be purchased in considerable numbers, immediately after or just before a declaration of war, and these could be attached to armoured ships: this I understand was done by Sir Geoffrey Hornby, when ordered with his fleet up the Dardanelles. Very useful indeed might some of these craft prove, but as a body they must have many disadvantages, and could only be classed as makeshifts when compared with the specially constructed vessels now proposed.

In proof of the urgent necessity of employing numerous and swift look-out vessels, even when the movements of hostile fleets were slow and governed by the winds, let me here make three quotations from Nelson's despatches referring to his great want of frigates, employed as they were in those days as swift look-out vessels. Writing on June 29, 1798, to Lord St. Vincent, some little time before the battle of the Nile, he says, "Here¹ I had deeply to regret

¹ "Nelson's Despatches," vol. iii.

my want of frigates, and I desire it may be understood, that if one-half the frigates your Lordship had ordered under my command had been with me, that I could not have wanted information of the French Fleet."

Not a month after, on the 20th July, 1798, in another letter to Lord St. Vincent, he writes, "Yesterday I arrived here, where I can learn no more than a vague conjecture that the French are gone to the eastward. Every moment I have to regret the frigates having left me, to which must be attributed my ignorance of the movements of the enemy." Again, in the postscript of a letter to Sir William Hamilton, dated "Vanguard," 23rd July, 1798, he writes as follows:—"No frigates! to which has been and may again be attributed the loss of the French Fleet."

Surely Nelson's wants must here be a lesson to us, to supplement our armour-clads with frigates or vessels swifter than themselves, to perform those duties which our great Admiral expected of his frigates. Then our frigates being avowedly too few and too costly for this work, ought we not to construct many swift vessels wherewith to replace them? feeling confident that the cost of their construction would be money well spent, and that independently of the greater efficiency, I had almost said protection, thus given to our armour-clads, would return us their value in full; also satisfied in our own minds that even in the event of a lesser war, when the armour-clads might not require their services, yet, that we could still turn these swift vessels to good account, by letting them loose over the wide-spreading ocean paths of our commerce, to convoy and protect our own ships, and to harass, burn, and capture those of our foes.

In conclusion, I would again say that it is my desire to submit for your consideration and discussion the question, whether in most, if not in all, the circumstances to which I have somewhat feebly endeavoured to direct your attention, small vessels of very high speed, capable of accompanying an armour-clad fleet, might not be a valuable supplement to that fleet, and otherwise be of the greatest service to the State?

Admiral Boys: Captain Colomb and gentlemen: I did not happen to be present when the lecture commenced, and really I find it difficult to open a discussion on the subject, as what Captain Harris has told us seems to be so evident, and he has pointed out so graphically the cases in which our armour-clads may be placed before an enemy's port, or even at sea, by the sudden attacks of swift vessels and gun and torpedo boats, that he seems to have left us hardly anything to say on the subject. I may, however, observe that I think he has given us a little too highly coloured a statement as to the conditions likely to result from this attack when made, because I consider that the chances are not so much in favour of the small vessels attacking a large armoured ship as he represents. I recollect Sir William Armstrong in his introductory address to the Civil Engineers, told us what Captain Harris has repeated, and he implied that three or four of these fast unarmoured ships were more than a match for a regularly constructed armour-clad. I do not quite agree with Sir William Armstrong in that respect, though I do agree with him as to the value of this description of vessels for certain purposes. I think in a direct attack upon armour-clads by small craft, the chances are in favour of the armour-clads. Captain Harris allows that the armour-clad may sink one out of four; but I think it more probable that she would sink three out of the four, or all four, because they are so

extremely vulnerable. One shot in nearly any position would disable or sink them; and one well-planted shell from a long-range armour-piercing gun would settle them. The same applies to an attack by gunboats. Some years ago we built gunboats of the "Staunch" class, to which he refers. No doubt they have their value, especially for the defence of ports; but for attacking armour-clads at sea I do not think them well adapted. There is one point which Captain Harris has not pointed out. You must recollect that the guns in these gunboats, although of the same calibre as in the armour-clads, are fixed in the boat, and are pointed by the steering of the vessel. More than that, a gunboat from its small size is much affected by the sea. The motion is considerable when the large vessel has a steady gun platform, the difference is much the same as shooting at a flying and shooting at a fixed object, only in a gunboat the gun is flying as well as the object. Still there is an actual necessity for us to supplement our fleets with vessels of something of the "Hecla" class—perhaps a little faster—and also gunboats and torpedo-boats. With regard to the "Hecla," although she is not speedy enough, she is an extremely valuable class of vessel. She not only carries numerous torpedoes and eight torpedo-boats, but she can carry 2,000 tons of stores. I myself went out in the "Hecla" to the Mediterranean with my flag up. During the ten days' passage to Malta we had a gale of wind against us, and a gale in our favour; and we only expended 200 tons of coal, while the ship had 2,000 tons in her when she left England. I think we are all deeply indebted to Captain Harris for bringing the question forward; and I think, from his showing, we must acknowledge that the supplementing of armour-clads with different descriptions of light vessels is a necessity at sea in war time.

Captain SEYMOUR CURTIS: I should like to ask one question. Can anybody tell me whether there is a single ironclad in the fleet of the present day which could start from Cork and steam straight to the coast of America, and have sufficient coal in her bunks then to be of the slightest use?

Admiral BOYS: It depends on her speed.

Captain SEYMOUR CURTIS: Let her make the best speed she can. With regard to the question of the shooting of the small gunboats, I was commander of an ironclad for two years and a half, and we fired away many hundred shots, and only hit one target. It is very hard to hit anything with an 80-ton gun at more than 500 or 600 yards.

The CHAIRMAN: I am afraid nobody has any further remarks to make, and so I must offer the lecturer the thanks of the meeting. I am sure the audience, small as it is, will very heartily join me in thanking Captain Harris for the very excellent paper we have listened to. Captain Harris must not judge that the size of this meeting has any relation to the importance of his paper. As a matter of fact, the paper he has read to-day is, I have reason to believe, the keynote of the ship-building policy of the day. I know it is one of those questions on the determination of which, either one way or the other, hinges our ship-building policy, perhaps for the next two or three years. It is a question which must be debated at the Admiralty, and which was raised by Mr. Barnaby at the Naval Architects four years ago. I have some figures here in a paper which, though marked "confidential," is not confidential as to facts, and I am at liberty to make use of them if I think proper. In these days, when cost has so much to say to it, I think that the table I am about to read has an important bearing on the paper we have just heard. One ironclad, carrying 500 men, will cost 500,000*l.*, and will carry 600 tons of fuel, and, say, two torpedo-boats. Six unarmoured ships, with 1,800 men, will cost 900,000*l.*, will carry 6,000 tons of fuel, and 24 torpedo-boats. Six torpedo rams, carrying 700 men, will cost 900,000*l.*, carry 1,200 tons of fuel, and no torpedo-boats of course. That force would be represented by 3,000 men, would cost 2,300,000*l.*, and carry 7,800 tons of fuel, and 26 torpedo-boats. On the other side, six ironclads, carrying 3,000 men, would cost 3,000,000*l.*, would carry 3,600 tons of fuel, and 12 torpedo-boats. The writer of the paper is strongly in favour of supplementing each individual ironclad by a force of light ships, such as the lecturer has described. I was very much struck myself with Captain Harris's statements as to the use of light ships attached to ironclads in the open sea in time of war—the enormous circle which can be swept by a few light ships of very great speed in a

very short time; and the great importance in the way of saving of fuel that this would be to any fleet that had them attached to it, enabling the ironclads to rest quietly with very low fires, knowing that long before the approach of a hostile fleet they could make their dispositions, get steam up, and have everything ready. Nothing but light swift ships could do that without an expenditure of fuel not to be thought of. I was also struck with the use of the light ships attached to an ironclad fleet in case of blockading. Of course a blockading fleet can be driven off now by means not dreamed of in the old days. The torpedo-boats and torpedo-vessels, with the Whitehead torpedo, will be a terrible matter for an inshore squadron to face. It seems to me that an inshore squadron now must be represented by some light ships as look-out ships, such as have been described. I think what the lecturer wants to do really is to get us to establish in our minds as a principle that the ironclad is not to be, as a rule, unaccompanied by consorts of this light kind. That is the point. We know that our naval policy is tending towards that. The building of the "Iris," the "Mercury," and other ships of the same class now in process of construction, show us that that idea is already afloat, so to speak. I must say I do not know that I ever read a paper which pleased me so much by the nature of its diction, and the clear way in which the statements are made; and what the lecturer wishes to impress upon us is that we should carry in our minds the necessity of always looking upon the ironclad as a fighting citadel, as it were; to be surrounded by light earth-works, which are to be the guards, to be destroyed, so to speak—if they are to be destroyed at all—before the main attack comes. There would be the light line of skirmishers, who would commence the attack, to be followed afterwards by the heavy ironclads. I am sure that by and by, in a year or two, this paper will be referred to as giving a starting point to the policy of the future; although, myself, I am not quite prepared as yet to desert the simplicity of the old serried rank of the ironclads, one astern of the other, for making a solid attack. But, of course, opinions differ. I am quite sure you will all join in a hearty vote of thanks to the lecturer for his most admirable paper.

Friday, January 19, 1883.

VICE-ADMIRAL H. BOYS, Member of Council, in the Chair.

THE LAY AND OTHER LOCOMOTIVE TORPEDOES CON-
SIDERED FOR THE PURPOSE OF COAST DEFENCE,
AND ALSO AS THE ARMAMENT OF SHIPS, TORPEDO
AND SUBMARINE BOATS.

By Lieutenant C. SLEEMAN, late R.N.

IN discussing this question of the employment of the Lay locomotive torpedo for general service, it will be necessary first to briefly describe the other torpedoes of this nature that at present exist, and point out their advantages and disadvantages.

Locomotive torpedoes, that is, submarine weapons which possess within themselves their power of locomotion, may be divided into two distinct classes:—

1st. Uncontrollable locomotive torpedoes, that is, those which cannot be controlled or directed at the will of an operator.

2nd. Controllable locomotive torpedoes which are under an operator's control.

The latter class may be further divided into controllable locomotive torpedoes requiring special appliances for maintaining their motive power, and fixed stations or specially fitted vessels or boats to manœuvre them from, and torpedoes of that nature which act independently of such.

In Class I, I place—

The "Whitehead" fish torpedo.

In Class II (A), I place—

The "Brennan" torpedo and

The "Ericsson" (tube) torpedo.

And in the same class (B)—

The "Lay" torpedo.

CLASS I.—*Uncontrollable Locomotive Torpedoes.*

Of this class the Whitehead stands alone, and is decidedly *par excellence* the most perfect torpedo of this kind that exists at the present time, or is likely to be invented.

The highest speed attained by the Whitehead is, I believe, 26 knots for 200 yards, $23\frac{1}{2}$ knots for 400 yards, and 18 knots for 800 yards. In calm weather and in places where no tide or current is experienced this torpedo may be discharged with accuracy at a distance of 500

yards, even when the vessel using it is proceeding ahead at the rate of 17 knots per hour; but to effect such good practice very great experience is necessary in adjusting the torpedo. Practice with this torpedo by men who are not experts would not be attempted with a vessel at a speed greater than 10 knots per hour, and then under favourable conditions there is fair certainty of hitting a moving vessel at the distance of 300 to 400 yards.

The mere fact of its having been universally adopted by the principal naval Powers entitles the Whitehead to be highly considered, but in the hands of those who would have to manipulate it in time of war it seems to require too careful adjustment, and too many niceties of calculation, as to the distance and speed of the vessel aimed at, to prove as reliable as it is absolutely necessary such a weapon should be under the peculiar conditions met with in actual war.

The advantage of the Whitehead are that up to its limit of accurate range (500 yards) it is entirely self-acting—that is, that the vessel using it, when once a Whitehead has been fired, has nothing further to do with it, and also its great speed for this distance of 500 yards, which it only takes some forty seconds to cover.

The disadvantages of the Whitehead are—

1st. Its limited accurate range (500 yards).

2nd. The complicated nature of its adjustments.

3rd. The necessity of discharging it from special apparatus.

It is possible to start the Whitehead from above water, but then its inaccuracy is so seriously increased as to render this method comparatively useless.

4th. Its comparatively weak power due to the small charge of explosive carried.

The charge for the large 15-inch Whitehead of 19 feet in length is only 80 lbs., while that for the 14-inch one of 14 feet in length is only from 30 to 40 lbs. of gun-cotton.

5th. When once started the course of the Whitehead cannot be altered to meet any sudden change in the direction of the vessel aimed at, and also it must be set so as to sink at the end of its run on actual service, so as not to remain floating about to the detriment of friends as well as of foes.

And when practising with this torpedo it must be set to float at the end of its run so that it can be recovered, which has not been always successful.

In Germany, Whitehead torpedoes are constructed by Messrs. Swartzkoff and Co., which only differ from the real Whiteheads in that their cases are formed of phosphor-bronze in the place of steel, the object being chiefly the reduction of cost.

In summing up the merits of the Whitehead torpedo, it may be considered a very powerful weapon, and under favourable conditions is fairly accurate up to a range of 500 yards, either as a ship weapon, or when used from the shore for harbour and river defence, or as the armament of torpedo-ships and torpedo-boats.

The German Government have made some experiments, I believe, with sunken batteries containing several Whiteheads discharged from

the battery by electrical means under the control of those on the shore batteries. By this means it is intended to increase the present limited range of those torpedoes. What success has ensued I am unfortunately unaware of. Here the direction in which the Whitehead would be fired remains constant, and therefore this method could only be used when the enemy's vessel had reached a certain position, and also only in ports where little or no tide or current is experienced, and where a shelving shore running out under water a long way admits of the sunken battery being placed.

CLASS II (A).—*Controllable Locomotive Torpedoes.*

Of this class there are two representatives, and of these I will first discuss the Ericsson controllable locomotive torpedo.

This weapon has for its motive and directive power compressed air, which is pumped into the boat through an india-rubber tube of 1 inch diameter, and is thus supplied to the engines and steering gear. The india-rubber tube is unreeled from the shore as the torpedo moves ahead.

The disadvantages of this Ericsson torpedo are principally—

1st. The employment of a flexible tube, which by fouling prevents any or the proper supply of air being maintained.

2nd. Owing to its size a great length of tube cannot well be dragged out, and therefore its range is very limited.

3rd. It has to be manœuvred from stations or vessels specially fitted with apparatus for pumping in the compressed air.

4th. Its want of speed, due to the work required to be expended in dragging out the tube.

This torpedo has been tried in America, but has otherwise not been brought into public notice, and its trials there were not successful.

I now come to the Brennan controllable locomotive torpedo, which is an Australian invention, and which has been lately experimented with at Chatham.

The Brennan may be termed a "mechanical" locomotive torpedo, that is to say, it is moved ahead and steered entirely by mechanical means.

The mode of propulsion adopted in the Brennan is that of connecting the shaft of two drums placed in the body of the torpedo to its screw shaft, so that on the unwinding of the fine wire previously reeled up on those drums, the latter are made to revolve, and imparts in turn a revolving motion to the screw. To perform this work it is necessary to have a steam-engine and two reels at the directing point, which reels being revolved wind the wire from off the drums in the torpedo, whereby they and the screw are revolved and the torpedo moved ahead. The steering is effected by increasing or decreasing the velocity of either of the short reels, which imparts motion by means of tiller ropes to the rudder. The wire used is similar to the steel wire employed by Sir William Thomson in his deep-sea sounding apparatus. The torpedo is directed by means of a steel telescopic mast carrying a pennon.

The torpedo, according to Mr. Brennan's patent specification, can be

run at different depths by an arrangement somewhat similar to that used in the Whitehead torpedo.

In the Chatham trials I believe that a speed of 14 knots per hour was obtained, but for what distance I am not informed, and it was considered to be controllable up to about 1,200 yards; here, again, I am unable to state what was the nature of the experiment instituted to prove this fact, nor am I able to inform you as to the size or the weight of the torpedo tried there, or its explosive capacity.

In the afore-mentioned specification Mr. Brennan very modestly claims for his torpedo, 9 feet in length and weighing 3 cwt., a speed of 6 or 7 miles per hour for a distance of 300 yards.

A torpedo of those dimensions could not carry a sufficient amount of explosive compound.

Four times the amount of wire must be coiled on the torpedo drums for the distance that it can run; for instance, for a $\frac{1}{2}$ mile run, 2 miles of the wire would have to be reeled up.

The advantages claimed for the Brennan torpedo are—

1st. Great simplicity.

2nd. Its small cost.

Its disadvantages are—

1st. The necessity of working it from a fixed station or stationary vessel, where is placed the steam-engine and winding-up reels.

2nd. The risk of a kink occurring in either of the wires, which, on any strain being brought on the kinked wire, would most certainly snap it in two.

3rd. Its apparent want of range. I believe it is capable of being steered with some certainty up to a distance of 1,000 yards.

4th. The fact that the wires must lie very near to or on the surface, and therefore might be got at by the enemy, or damaged by the passage of a friendly ship or boat.

5th. That the fouling of one or other of the two wires with any obstacle in the path would disable the torpedo, and probably break the wire so fouled, by reason of the great speed at which it must be dragged through the water in the process of unreeling the wire from the torpedo and reeling it up on the shore drums.

6th. Its directing mast is not lowered or raised at will, and therefore remains up during the whole of its run. The mast can be forced down when meeting with any obstacle, and when free at once resumes its upright position.

7th. Its having only one mast to direct it by, which must seriously militate against very accurate aim being obtained.

8th. It cannot be steered back to the point it is started from, but must be dragged back by its wires.

I must here state that I have never seen the Brennan torpedo in practice, but have stated its merits and demerits as they appear to me from information I have been afforded by those who have actually witnessed some of the trials made with it in Australia and here, and also from a study of Mr. Brennan's patents, and, therefore, some of my surmises may possibly be wrong, if so, I shall be only too pleased to be corrected on those points.

CLASS II (B).—*Controllable Locomotive Torpedoes.*

In this class there is at the present time only one torpedo, viz., the "Lay Controllable Locomotive Torpedo," which does not require to be manœuvred from any fixed station or specially-fitted vessel or boat.

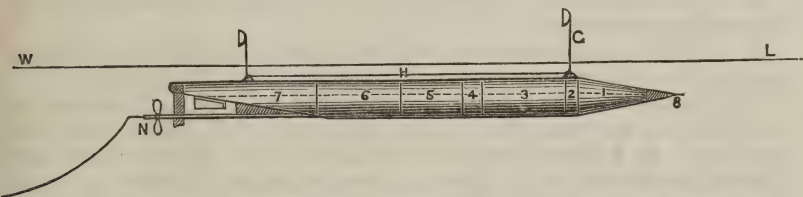
In affording a description of the Lay torpedo, I take as a specimen the one I have personally assisted to take to pieces and fit up, and also helped to manœuvre on two trials made with it by the Imperial Ottoman Government, only some few months ago; and which same torpedo has been successfully experimented with in Russia and Belgium.

Besides this one, there is the improved type of Lay, ten of which were built for the Russian Government by Colonel Lay, and all of which were entirely successful.

In addition to these Lay torpedoes there is another one nearly completed, which will embody many important improvements, even on the Russian design, and have a speed of at least 14 miles per hour.

The Lay torpedo I propose to explain here, of which a sketch is shown in Diagram 1, is constructed of steel of $\frac{1}{8}$ inch thickness, and is divided into three distinct sections, viz., the bow section, the reservoir section, and the after section. The total length over all is 26 feet, its maximum diameter is 24 inches, and it weighs when completely loaded about $1\frac{1}{2}$ tons.

DIAGRAM 1.



The Bow Section is divided into two compartments, viz., the magazine and the guide-rod compartment.

1. *The Magazine.*—The amount of explosive carried in this type of Lay torpedo is 90 lbs. of dynamite; in the Russian Lay torpedoes it is increased to 150 lbs., and the same amount or more will be carried in the improved one now being constructed; at the same time neither the length or weight of these Lays is increased.

The charge can be exploded either "at will" or by contact.

In this chamber is arranged a device whereby the blow of impact on the torpedo striking a ship is taken up by the pressure of a piston on a cushion of water.

The magazine in this torpedo was fixed, but in the Russian type and in the new torpedoes the magazine will be arranged to drop automatically on impact a distance of 7 or more feet to the end of a small

chain or wire rope, and explode by mechanical means at the moment of reaching this depth.

2. *The Guide-rod Compartment.*—Here is contained the apparatus for raising and lowering the foremost guide-rod marked G, which can be performed at any time at the will of the operator.

The Reservoir Section.—Here is contained the motor of the Lay torpedo, which is carbonic acid gas (represented by the chemical formula CO^2).

The After Section contains the balance, cable, engine, and steering compartments.

1. *The Balance Compartment.*—Herein is contained an ingenious device whereby a certain portion of water is allowed to flow in to counterbalance the weight of gas expended during the run, and so arranged that on stopping the torpedo the flow of water ceases.

2. *The Cable Compartment.*—Here the electric cable of the torpedo is stowed, by which the various functions of the torpedo are directed by the electric current flowing along it.

This cable is formed of four insulated cores braided over, and the weight of 1 mile of it is only some 260 lbs.

In the Lay torpedo used at Constantinople, and which I am now describing, the directing end of the cable was led out of a tube running through the hollow screw shaft and brought out well clear of the screw, as is shown at N in Diagram 1.

Colonel Lay now adopts the plan of running the torpedo cable directly out of the bottom of its compartment, as is shown in Diagram 4.

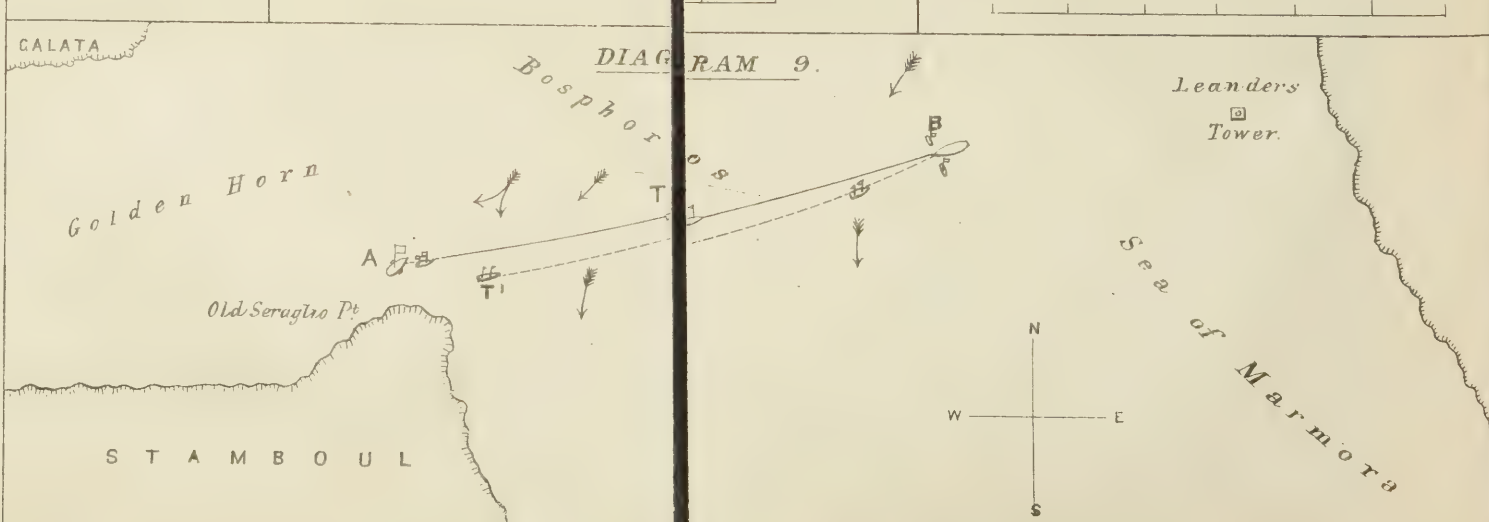
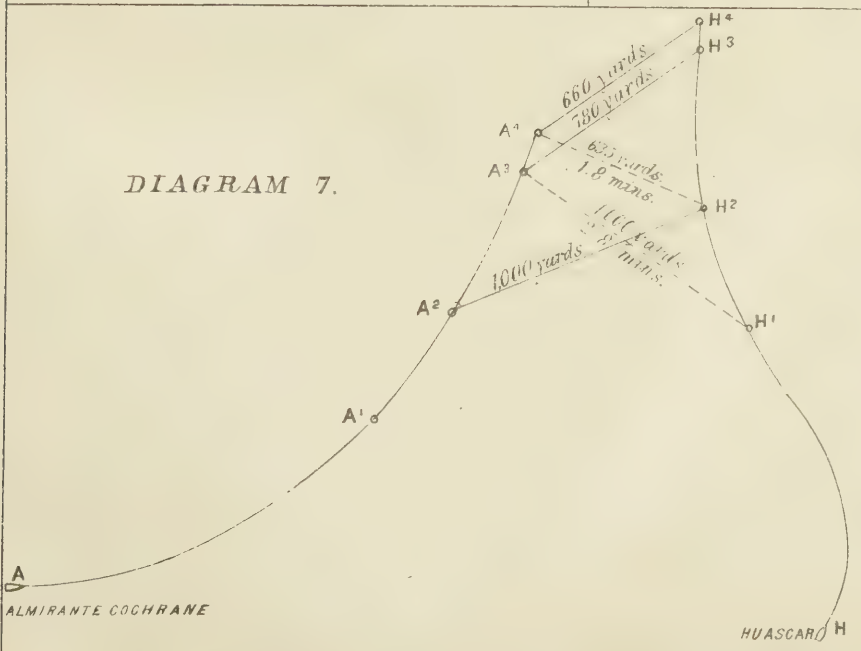
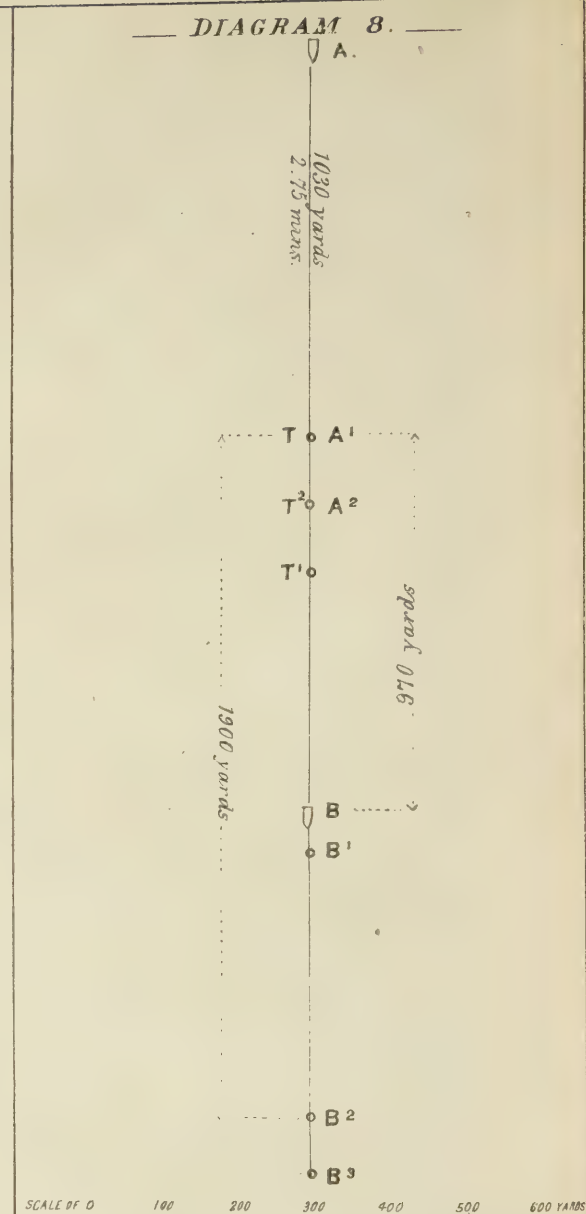
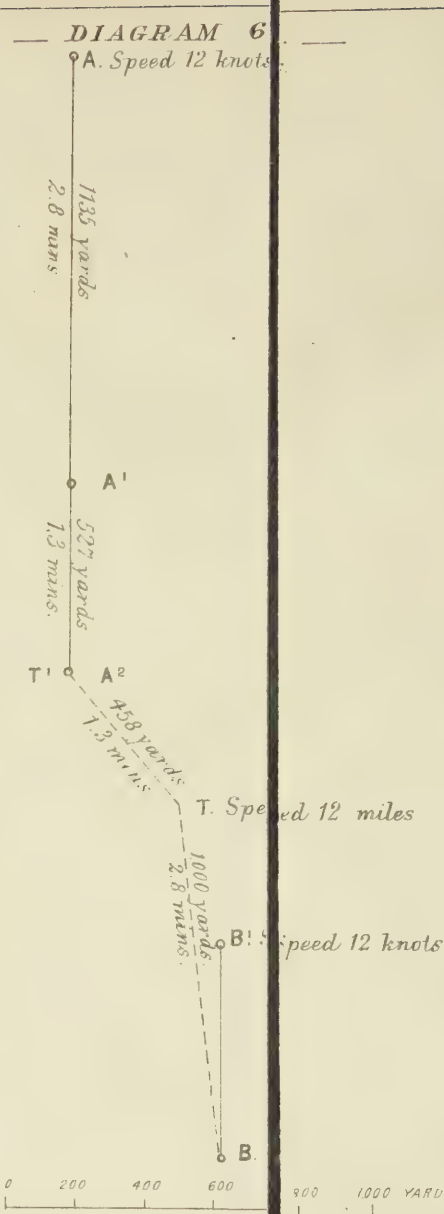
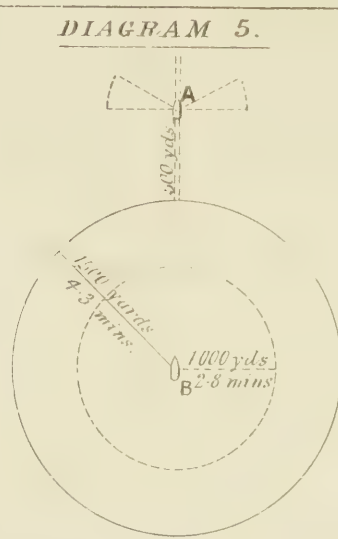
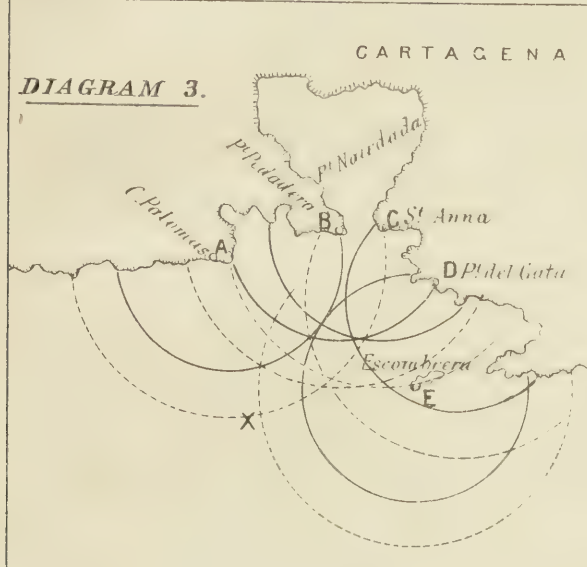
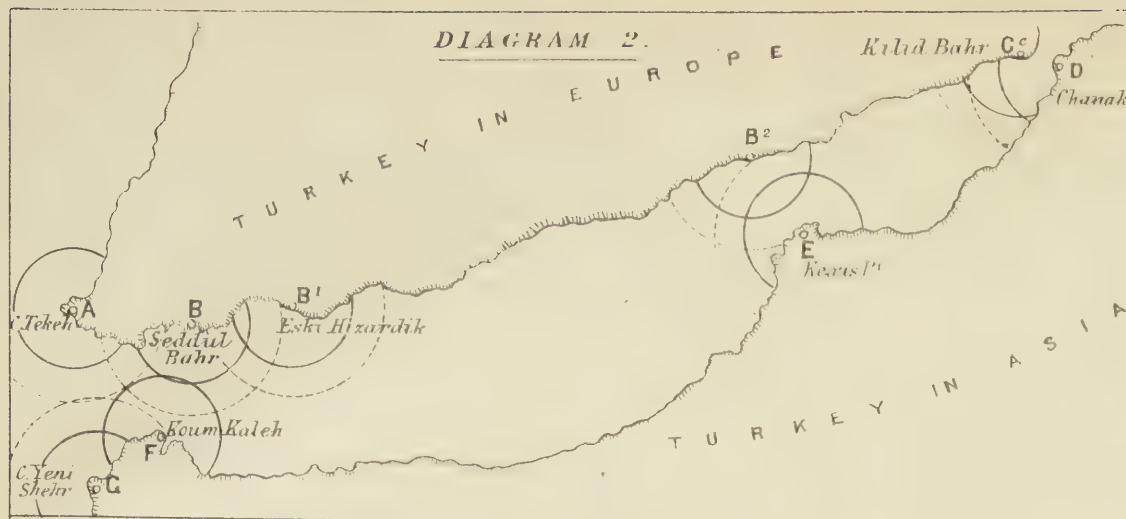
3. *The Engine Compartment.*—In this chamber is fixed the machinery for working the screw.

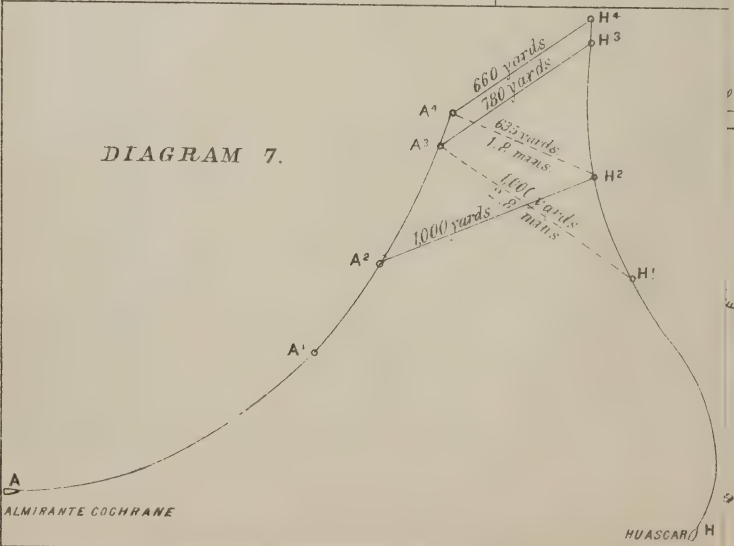
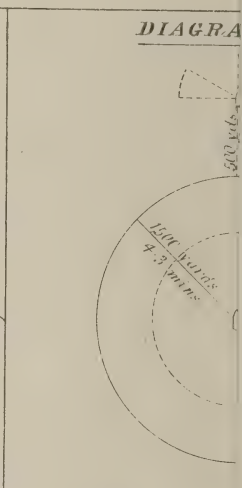
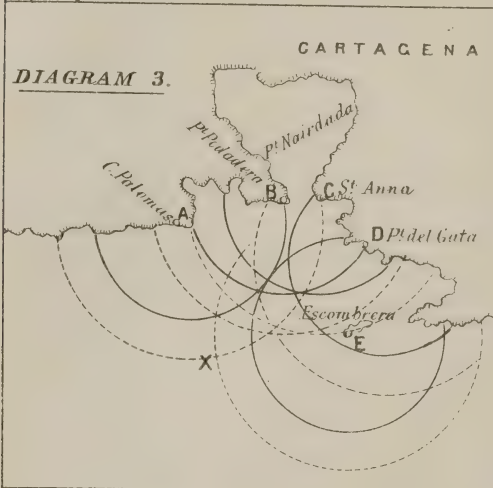
4. *The Steering Compartment.*—Here is contained the apparatus for moving the rudder to port and starboard at will of the operator.

The Guide-rods.—These are two thin iron rods, hinged the one on the fore part, and the other on the after part of the back of the torpedo, and as I have previously explained, these can be raised and lowered together at will. Each is provided with a disc for day runs, and a small oil lamp for night runs—the foremost disc being painted red, and the after one white, on their rear face, the front of them being painted black or grey. That is to say, the side of the discs facing the enemy would be painted the colour which experience has proved to be most difficult to discern, that is, black or grey; and the side of them facing the operator would be painted the two opposite colours most easily discerned, such as red and white.

These discs are detachable, and for night runs are replaced by lamps, which are shrouded in thin brass hoods, and are so pivoted on this hood that when the guide-rods are lowered, the face of the lamps lie on the torpedo. By this arrangement the lamps can only be seen by the operator, and not at all by the enemy, whether the guide-rods be up or down.

In day runs the torpedo can be brought back to the point it started from, as the sketch of the Constantinople trial shows—but at night time such cannot be very well done, unless, as it has been proposed, the





rods are arranged to be turned round at the will of the operator: such could be effected, but the question is, whether it is needed on actual service or not.

The guide-rods in the new Lay torpedoes will be placed on the side, so that when lowered they will not be liable to be exposed when the torpedo is at rest, or create any disturbance of the surface as the torpedo speeds along.

The Key-board.—This consists of a small box about 18 inches by 12 inches by 4 inches, which contains the ordinary electrical mechanism for the purpose of throwing in and out of circuit different currents, by means of keys worked on its upper surface.

In manipulating the torpedo, it would usually be only necessary to pay close attention to the steering key, after once the torpedo has been started, and the guide-rods raised; and the method of firing by contact would be the one usually adopted.

There now only remains to be noticed the "Battery" which generates the electricity by which the various functions of the torpedo are directed.

This may be any form of voltaic battery which will afford a sufficiently strong current, combined with portability.

Then to direct the torpedo, the operator has only to give the same orders as when steering any ordinary boat; key S being moved according to the order.

The operations of "stopping and starting the engines," "raising and lowering the guide-rods," moving the rudder to "port and star-board," can be performed at any time at the will of the operator during the run of the torpedo, as well as the firing of the charge at will.

I will now state what are the principal advantages of the Lay torpedo.

1st. It is perfectly controllable up to any distance equal to the length of its cable.

2nd. Its great range, which is only limited by the size of the torpedo, and the distance off at which the guide-discs may be kept in view by means of powerful binoculars. The range at present for the larger Lay torpedoes intended for harbour defence is $1\frac{1}{2}$ miles: for the smaller torpedoes to be used in ships and torpedo-boats, the range is $\frac{3}{4}$ to 1 mile.

3rd. Its speed of 12 to 14 miles per hour, for the whole length of its run.

4th. Its complete invisibility when the guide-rods are in the lowered position, due to the torpedo being then submerged at least 9 inches, and there being no disturbance visible on the surface as it moves along.

5th. Its great power due to the heavy charge of explosive carried; the amount ranging from 100 lbs. of dynamite for the ship torpedo to 150 lbs. or more, according to its size, for the harbour defence torpedo.

6th. Its extreme portability, that is to say, as the Lay does not require any apparatus for discharging it, the torpedo may be

manœuvred from any place where a body weighing $1\frac{1}{2}$ tons can be conveyed to, or from any ship or boat which can hold the battery and operators. It can be moved from point to point on shore, either by rail, or by an ordinary wagon, or special carriage drawn by horses or men.

It can be conveyed by any ship by hoisting it up to one of her boat davits (strengthened if needed for the purpose), or to improvised davits in a steam-tug, &c., as was used at Constantinople, or to specially constructed davits in a torpedo-ship or boat; or it may be simply towed by any craft, whether a steamer or a rowing boat.

Thus it would always be a matter of uncertainty to a blockading or bombarding force from what direction an attack by the Lay torpedo might be made. Again, the Lay may be used from any ship or boat at a moment's notice.

7th. It may be operated from a ship or boat without impeding her movements. A separate cable, coiled as in the torpedo, will be carried in the craft from which the Lay is to be manœuvred and connected up to the torpedo cable, by which means that craft may proceed as she pleases after starting a Lay, without dragging the cable out of the torpedo.

8th. It may be anchored or stopped with a break on its cable, to prevent it running out in a current or tideway, or while it drifts when stopped. The anchor will be slipped on putting the rudder over; the break will be taken off the cable on the engines being started, or put on the cable when the engines are stopped.

I will now discuss the two points that have been raised as objections against the use of the Lay torpedo: these are the protection afforded to ships by torpedo-nets, and the possibility of cutting its cable.

Torpedo-Nets as a Protection against the Lay Torpedo.

Here I will start with the assumption that ships are now supplied with a torpedo-net which will prevent any locomotive torpedo piercing it, and which maintains its depth at 20 feet and its supports not damaged when the ship using it is proceeding at a speed of 6 knots per hour. This is, I believe, granting everything in favour of ship torpedo-nets.

I assume that such a net would keep out a Whitehead, because if it cannot prevent that torpedo from piercing it, it is of no use against the Lay, which at a speed of 12 miles per hour strikes it a blow of 16,161 foot-pounds, at a distance of $1\frac{1}{2}$ miles, against 10,721 foot-pounds for the Whitehead, going 20 knots per hour, at a distance of 400 yards.

If a ship be protected by nets, the tactics to be adopted by those attacking her with the Lay torpedo would be to send out two of those torpedoes, one following closely behind the other, and possibly directed from different points. The first torpedo, with its enormous charge of 150 lbs. of dynamite, would most assuredly completely destroy the whole net protection and thus open a clear passage for the second

torpedo. If this charge of dynamite does not entirely destroy this net protection, it is of no use employing it to destroy a ship.

The then question naturally arises as to what would be the effect of the explosion of 150 lbs. of dynamite 10 yards distant from a ship and 7 feet below the surface. The answer to this, judging from the experience we possess of such matters is, that very considerable material damage would result to the ship, probably causing her temporary, if not complete, disablement by damaging her machinery or displacing some parts of it.

It has been proposed to provide a net of only a few feet in depth for the special and sole protection of ships against the Lay torpedo, and it is urged by this means that as considerably less surface would be exposed to the resistance of the water, so a greater speed might be maintained, and yet the net kept at its normal depth and its supports not carried away. This is of course merely a matter of conjecture. For my own part I do not believe this difference of 10 feet in the depth of a net would allow any greater speed to be maintained, and with the dropping magazine the Lay net would have to be at least 10 feet deep.

But in the event of a fleet bombarding or blockading a port it cannot be conceived that a sane commander would, on the *supposition* that he was to be attacked by the Lay only, order his ships to protect themselves with the small net, whereby he renders them vulnerable to a Whitehead or spar torpedo attack; and with few exceptions the Whitehead torpedoes, as well as the spar, are universally adopted, either in large or small numbers.

As I have before shown, if this objection as regards nets holds good against the use of the Lay, so much the more is it an argument against the use of any other controllable or uncontrollable locomotive torpedo.

Then when it is considered how at the best a ship's torpedo-net hampers her movements, it may be assumed that in actual practice such defence will be rarely resorted to, and that the protection afforded them against the Lay would be comparatively valueless.

Theory of disabling the Lay Torpedo by cutting its Cable.

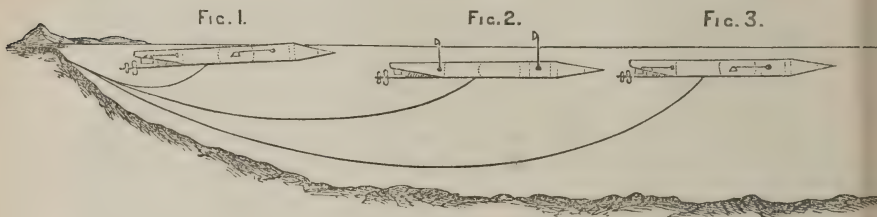
The original idea as to how this was to be performed was this: that a torpedo-boat should at full speed run close to the stern of the torpedo as it was moving ahead, pick up and cut its cable; the supposition being that the Lay torpedo dragged her cable along the *surface* of the water in her wake. Now in actual practice, as I trust I have been successful in explaining to you, the Lay torpedo neither *drags* her cable, nor can the cable remain on or near the surface, as its specific gravity is greater than that of water.

In the trials at Constantinople, where the depth of water was some 40 fathoms, or 240 feet, on picking up the cable some fifteen minutes after the torpedo had commenced to lay it, the cable was most decidedly at the bottom, as proved by its fouling some object lying there.

The cable weighs some 260 lbs. per mile; that is, each 7 yards weighs at least 1 lb. Specific gravity 1.61. As the cable of the Lay torpedo does

not float on or anywhere near the surface, but takes the position shown in Diagram 4, then the method of dragging would have to be adopted, and for any speed to be maintained by the boat with the drag kept at a normal depth of 30 to 40 feet, it would have to be attached to a *fixed* pole, a plan not apparently practicable. It may be doubted whether this method of a fixed drag on a spar will ever be attempted, which must seriously reduce the speed of a torpedo-boat as well as impede its free movements, which are the main attributes of such a craft, and besides offering no practicable chance of success.

DIAGRAM 4.



1. The Lay Torpedo at "rest," with the guide-rods "lowered."

2. The Lay Torpedo when "moving ahead," with the guide-rods "raised."

3. Same as Diagram 2, but with the guide-rods "lowered."

Then, allowing an attempt by a torpedo-boat to drag for the Lay torpedo to be organized, how would it be carried out, and how would it be met by those using the Lay?

The tactics adopted by the enemy would be to dash across the space between the Lay torpedo, when observed, and the point from which it is supposed to be directed. Then, as in the daytime all that could be seen of the Lay torpedo above the surface would be the two guide-disks, and at night-time nothing, unless the torpedo-boat be precisely astern of the Lay, I can assuredly claim that the torpedo-boat would be observed by the Lay operators long before those in the former boat had discerned the torpedo, and so the operators of the torpedo would have the advantage in this respect.

Wherever possible, the Lay torpedo would be accompanied by one or more Nordenfelt anti-torpedo-boat guns, mounted on a field carriage, if it be directed from a point on the shore not fortified, or by a torpedo- or other fast steam-boat, armed with similar guns, or by a combination of a torpedo-boat and field gun. Again, two Lay torpedoes should always be used if possible, each directed from a different point.

Then the Lay operators, observing the enemy's torpedo-boat, if only one torpedo be used, would manœuvre it by using the guide-rods as little as possible and stopping her now and then, so that it would be quite impossible for those in the torpedo-boat to know in which direction she had come or was proceeding.

Or if two Lays are being used, one would be utilized to attack the enemy's torpedo-boat, not actually wasting the torpedo on her, but to

frighten her off by it, while the other torpedo would be quietly proceeding on its way to the attack of the ship.

Or the torpedo-boat of the defence could be sent to attack the enemy's craft.

From what I have said I think it is apparent to practical men that the possibility of disabling a Lay by the cutting of its cable, which does not float but sinks rapidly to the bottom, and in the face of other difficulties may be regarded as quite out of the question with regard to the Lay, but is possibly more feasible in respect to the Brennan torpedo, whose wires are near the surface.

A fog will of course prevent the use of a Lay or any other but a fixed torpedo, and will also equally militate against a blockading or attacking fleet.

As regards a ship being enveloped by the smoke of her guns, if the Lay has been run close to the ship, say 200 to 100 yards from her, before this occurs, it will accomplish the remaining distance without requiring to be seen by the operator.

I will now briefly describe the Nordenfelt submarine boat.

This submarine boat is built of Swedish steel of $\frac{1}{2}$ -inch and $\frac{5}{8}$ -inch thickness and weighs about 60 tons. On several occasions this boat has been experimented with, and its crew of three men have remained at considerable depths below the surface of the water for long intervals of time without any discomfort. There is no possibility of any danger of this boat when once submerged not being brought to the surface whenever desired, because there are two distinct methods of performing this; one by the aid of the engines, and the other by instantly relieving her of her water-ballast, and allowing the excess of buoyancy thus afforded to the boat to bring her at once to the surface. The Nordenfelt submarine boat can be used in three ways: first, with her turret above water and her funnel up, when she shows about 5 feet above the surface; secondly, when submerged until nothing remains above the surface but her glass dome, 18 inches in height; thirdly, when she is completely submerged at any depth which may be desired.

This boat will be armed with two Lay torpedoes and one rocket torpedo. The tactics to be resorted to with this novel craft are stated in Section III of this paper.

For convenience sake I have divided the tactical question of the Lay torpedo into three sections.

SECTION I.—*The Lay Locomotive Torpedo considered as a Function of Harbour Torpedo Defence.*

When the complex and numerous duties which must devolve on the navy of a Power possessing any extent of sea-coast are considered, including the actual defence of her military and commercial ports, as well as the ordinary work of a navy, such as the blockading of the enemy's ports, prevention of the same being effected to her ports, the protection of her trade routes, convoy of troops, &c., it may be asserted with truth, "That any navy of the present day is numerically

very weak." And this assertion is further strengthened by the fact of the impossibility of increasing a navy during a time of war, with the necessary promptitude, by building war-ships as powerful as it is now-a-days necessary to construct them.

This almost axiom is applicable more particularly to England, for though her Navy is undoubtedly numerically stronger than that of any other Power, and as a whole more powerful, yet it is not stronger in regard to the number of war-vessels in the same degree proportionate to the immensity of work it would have to execute in the event of her becoming involved in an European war, which would possibly mean a powerful coalition against her.

For, with all her dependencies and colonies, and the vital necessity that exists for maintaining in safety her trade routes, it would be forced on the British Navy to act almost entirely on the offensive.

It must be remembered, that not only must there be constructed a powerful sea-going fleet, coast defence ships, swift cruisers, troop and store ships, gunboats, and torpedo ships and boats, but also an adequate reserve of the same fully equipped, to fill up immediately the gaps caused by the sinking or serious damaging of the ships by the ram, gun, and torpedo.

Further, from the result of the late naval engagement of forts, the deduction may be drawn, that a fleet of powerful ironclads will have immense advantages when engaging shore batteries, even of great strength and power, if the ships possess the right of choosing their own positions, as regards distance and direction, and can move with impunity over the whole ground in the front, and on the flanks of the land-works, by reason of the entire absence of submarine or other torpedo defence.

Then, what I wish to establish by the foregoing statements, is—

1st. That with the numerical weakness inherent in the navies of the present day, it would be impracticable in a time of war to supply ships for the defence of the principal ports, especially in the case of England, France, America, China, and Russia, and at the same time carry on the war in an effective manner.

2nd. That the defence of harbours by fortifications and fixed torpedoes, when deprived of the support of ironclads, is too limited in range, and too passive.

Now there seem to be only two remedies open by which this want in the present methods of harbour defence may be supplied, viz.:—

1st. By increasing numerically the strength of a navy, either by constructing special vessels for this purpose, or by adding to the sea-going fleet, and detailing one or more ships for each important port.

The first part of this remedy, which has been to some small extent attempted, has not commended itself favourably to naval men generally, for many sound and excellent reasons, which it is not the purpose of this paper to discuss. As regards the latter part, when it is remembered how imperative it is to increase the number of sea-going ironclads of any naval Power, it would seem preposterous to construct a number of them which would, during the greater part of a war be locked up, and actually useless.

2nd. By employing the best available locomotive torpedo, either by itself, or in combination with a submarine boat.

Now this remedy seems to supply all the requirements necessary for the auxiliary defence of harbours, by which they shall be rendered self-dependent, that is, independent of the support of ships, thereby, it may be said, increasing the numerical strength of a navy by considerably decreasing the duties it would have to perform.

With every confidence, then, I claim for the Lay locomotive torpedo the power of fulfilling in the highest degree the essential features of a locomotive torpedo for the purposes of harbour defence.

1st. It is absolutely controllable up to any distance that the guide discs can be seen.

2nd. It has a range of $1\frac{1}{2}$ miles (2,640 yards), which may be increased to 2 miles (3,520 yards).

3rd. With the guide-rods down, there is no indication afforded of its position whilst moving ahead.

4th. Its speed is 14 miles per hour, which is maintained for the whole of its run.

5th. It carries a very heavy explosive charge.

6th. It can be anchored, and a break put on its cable to prevent it running out in a current, and this anchor slipped, and break freed at will.

7th. Its extreme portability.

The causes necessitating the features of controllability, and great range, are self-evident; for a torpedo employed in harbour defence must be capable of being manœuvred in tides or currents, and in a sea-way, as well as against vessels under weigh, and therefore constantly altering their position; and must besides possess the greatest range possible, so that the ships attacking the land batteries may be forced to carry out that work at the furthest distance, and also for the protection of all the "dead water," by which I mean that portion of the water in front of a system of fortifications which cannot, by virtue of the contour of the coast-line, be covered by the guns of the forts.

Further, to render the recurrence of the sight witnessed during the late bombardment an utter impossibility, namely, wooden gun-boats shelling, and helping materially to silence, a heavily-armed fort at the absurdly close range of 800 to 500 yards.

Though instances have occurred of vessels bombarding a fortified town at the great distance of 9,000 yards, yet if the real object of the attacking force is the destruction of the fortifications, and not merely the throwing of a few shell into the town, or perhaps one here or there into the batteries, the range must be very materially decreased, even, judging from our late experience, to well within 3,000 yards. The average range of the big ships in the late bombardment was, at the outside, 1,800 yards. Then, vessels attacking forts will move at a comparatively slow rate of speed, and therefore 14 miles per hour for the torpedo will be ample; and the greater amount of explosive carried, the greater certainty there is of effecting the complete dis-

abling or destruction of a vessel, no matter at what point the torpedo may strike her.

Again, it may often be advisable to run a couple of torpedoes out from opposite stations, and anchor them mid-stream, so as to be ready to intercept an enemy's vessel attempting in the early morn to rush the entrance, or dash in and disembark a landing party, and for many other purposes.

Further, the feature of portability and the absence of any special apparatus for discharging or starting the Lay on its way, which is one of the most objectionable features of the Brennan, Whitehead, and other locomotive torpedoes, will prove, under certain conditions, decidedly valuable: for by this property the Lay can be easily transported along the shore on a wheeled carriage, or be towed by an ordinary small rowing or steamboat: and thus a blockading force could never be sure from what point an attack with the Lay torpedo might be made.

Lastly, the property of invisibility which the Lay possesses most completely is extremely necessary.

With the Brennan torpedo its single guide-rod is raised at the commencement of its run, and cannot be lowered at will—while the Whitehead's course is marked by a very decided ripple, which would be rendered more distinct in a night-run in phosphorescent water.

So far, I have treated the Lay torpedo as acting by itself, but it may also be carried or towed by the small gunboats carrying one heavy gun, such as the English "Comet," or the Chinese "Alpha," which vessels will enter largely into the defence of estuaries, rivers, &c., or by the specially constructed torpedo-boats.

By means of these gunboats and torpedo-boats, the range of the Lay would be increased indefinitely—that is to say, it would be $1\frac{1}{2}$ miles plus the distance from the shore of the craft carrying it.

In the hazy light of the early morning, or in the dusk of the evening, the gunboat or torpedo-boat, being comparatively a very small object, would stand a very good chance of securing a position distant 1 mile from the attacking force without being discerned, and from that point conduct her Lay torpedo attack with impunity: even in the daytime the torpedo-boats by their rapid movements, and by virtue of their not being forced to remain at any one position when manœuvring a Lay would present but little opportunity at $1\frac{1}{2}$ miles distance to the guns of a ship.

Further, and here the extreme limit of the power of the Lay torpedo is obtained, that weapon will form the armament of the Nordenfelt submarine boat, which, owing to the exceedingly small surface of its dome exposed above water, would be able to take up a position distant 1 mile or less from a ship with the least likelihood of being observed, and thence manœuvre the Lay without having recourse to its submarine properties.

Then, by using the Lay torpedo in combination with gunboats, torpedo-boats, or the Nordenfelt submarine boat, especially in the latter instances, it would, in the face of this offensive defence, be almost impossible to conduct a naval attack on the land defences of a

port or entrance with any probability of success, if the object of such attack be the reduction of the fortifications previous to the capture of the port, or the forcing of the entrance.

This point I may fairly claim without laying myself open to the accusation of having over-exaggerated the value of the Lay torpedo for coast defence when used by itself, or in conjunction with the Nordenfelt submarine boat or the Thornycroft and Yarrow torpedo-boats.

As an illustration of the foregoing I have constructed two charts; Diagram 2 being that of the entrance to the Dardanelles, and Diagram 3 being that of the Port of Cartagena.

In the case of the entrance to the Dardanelles, which at its widest part, viz., from Cape Tekeh to Cape Yeni Shehr, is only some 3 miles, and at its narrowest, viz., from Seddul Bahr to Koum Kaleh, is only $1\frac{1}{2}$ miles across, and where is experienced a current varying from a rate of 2 to 6 miles per hour, is a position most suitable for the employment of the Lay torpedo: the strong current and eddies frequent here would put out of the question the use of any uncontrollable torpedo.

I have chosen five positions at the entrance from which the Lay torpedo could be manœuvred to guard it completely from any attempt made to force it, and also by which the attacking vessels would be obliged to carry on the bombardment of the forts from a distance of $1\frac{1}{2}$ miles, or 2,640 yards, which is beyond the range of fair accuracy of fire.

The full lines A, B, B', F, and G represent circles whose radii are each 1 mile, and whose centres are the positions similarly marked on the shore; the four dotted lines are portions of circles of $1\frac{1}{2}$ mile radius, described from the four outer points.

The Isle of Tenedos lies only 10 miles S.W. of Koum Kaleh, and Mayro Isle only 4 miles W.S.W., at each of which places batteries would be established supported by the Lay torpedo.

Supposing the immediate entrance of the Dardanelles to have been forced, then the enemy would have to encounter the forts guarding the passage between Chanak and Kilid Bahr, where the strongest currents and eddies are met with, and also the Lay torpedo, which would be manœuvred first from the Kess point and B² point, and again from points C and D, only distant 2 miles from the entrance; here, as before, the dotted lines and full lines represent portions of a circle of radius $1\frac{1}{2}$ and 1 mile respectively.

Further, at Cape Nagara, 3 miles above Chanak, where the straits take a great sweep to the eastward, and where the opposite shore is only 1 mile distant, other Lay torpedoes would be used; so also at Cape Peskieri, where the strait is $1\frac{1}{2}$ miles wide, and at Gallipoli, where it is $1\frac{3}{4}$ miles wide.

Then, coming to the consideration of the Port of Cartagena, Diagram 3, though no rapid currents are met with here, yet the configuration of the coast-line offers a position where the Lay torpedo, by reason of its extreme range, would most assuredly increase the ordinary defences. In this case the dotted lines represent the circles

of 1 mile radius, and the full lines those of $1\frac{1}{2}$ miles radius. The positions from which the Lay torpedoes would be manœuvred are Cape Palomas, Point Podadera, St. Anna, Point del Gata, and from the outlying island Escombrera.

For the attack of the fortifications at point B, the nearest position at which the ships could engage outside the limit of the Lay torpedoes (when operated from the shore) would be at X, distant $1\frac{3}{4}$ miles, where they would be in the direct line of concentrated fire from all the shore batteries.

Then there is always the possibility, and not at all an uncommon one, of one or more of the attacking vessels running aground from time to time, which might very likely occur at a point not strongly commanded by the shore batteries, but a ship in such a position must fall an easy prey to the Lay torpedoes of the defence.

I have refrained from citing instances of attack by fleets on fortified harbours and river entrances, which occurred during the American Civil War, and which were usually successful, for though it would have furnished striking illustrations of the value of the Lay torpedo, had such been possessed by the Confederates, because the conditions of naval warfare have so materially altered during the last 20 years; for instance, in these days of costly and huge ironclads, the capture of a port with the loss of three or four such ships could hardly be considered a victory, owing to the extreme difficulty and great time required to replace them, while in the old days of wooden ships, the loss of several of them in a sea fight or bombardment was hardly considered.

I will make only one quotation from Captain Long's, R.N., excellent lecture on the "Study of the Tactics of Naval Blockade;"¹ here, in summing up on the attack made on Charleston by the Federals, he states:—"That the small height of Fort Wagner above the water, and the lowness of the approaches, rendered it the most favourable object for the attack of vessels which could approach within 300 yards at high water, and take it in reverse without being nearer Forts Sumter and Moultrie than 2,300 yards."

This is a practical illustration of one of the numerous weak points that must often exist in a system of land defences, unsupported by some weapon, such as the Lay torpedo, possessing great range.

I will now proceed to Section II.

SECTION II.—*The Lay Torpedo considered as a Function of Ship Attack and Defence.*

The question of naval tactics has been during the last few years much discussed in this theatre and outside, and also many papers have been written on this abstruse subject, by some of the ablest Officers of our own and foreign navies, in all of which it has been unanimously agreed upon to consider the ram, and the gun, as a ship's only tactical arms. At the same time it is usually stated, as a premise, that a ship is dependent for her weapons of attack and defence on three arms, viz.:

¹ See Journal Royal United Service Institution.

the ram, the gun, and the torpedo—and further that it is imperative that a decision should be made beforehand and strictly adhered to, by the commander of a squadron or captain of a ship, as to which of those arms he intends to treat as his principal weapon, and to arrange his tactics accordingly, the arm chosen being usually the ram, and though the torpedo is spoken of as an auxiliary weapon, yet in all the tactical problems set forth, the positions assigned on paper to the rival vessels are considered only in reference to the opportunities afforded them to ram or to use their guns.

The reasons for thus ignoring the third arm (torpedo) in the study of naval tactics, may be considered to be twofold:—

1st. That the only torpedoes with which ships have been or are now armed, are the towing, the spar, and the Whitehead. The former is a very clever weapon, and would prove no doubt of value in an action on the open sea, under certain circumstances, but it is more particularly a weapon to be used from a special vessel.

The spar torpedo may, under certain exceptional circumstances, be of use as a *ship* weapon, but its tactical value on account of its being a fixture to the ship, and only having a range of 30 feet, is small: ships are now generally supplied with boom or spar torpedoes for the purpose of deterring a ram attack.

The Whitehead, owing to its range being comparatively limited, (only some 500 yards), and also that it requires the vessel using it to be heading properly before it can be discharged with accuracy, does not enable any great practical tactical value to be attached to this arm.

2nd. That with the exception of one occasion (where it failed) ships armed with locomotive torpedoes have not been engaged, and therefore the actual practical knowledge that can be brought to bear in discussing the tactical position of the locomotive torpedo in future naval combats is considerably less than what is to be obtained in reference to the other arms—the ram, and the gun.

Now, by arming ships with the Lay locomotive torpedo, I trust to be able to show naval tacticians that greater deference is due to the locomotive torpedo, considered as a weapon of ship attack and defence, also that in future, when preparing problems on naval tactics or in discussing that subject, the power of this torpedo necessitates more serious attention and importance being paid to it than has hitherto been accorded to that arm. At the same time, I trust it will be understood I have no intention of “rushing in where, it may be said, angels fear to tread,” and teach the science of naval tactics, but I merely desire to point out, and invite discussion thereon, certain positions in a naval engagement where the Lay type of locomotive would become an exceedingly valuable factor.

From a perusal of the principal lectures and essays written of late on naval tactics, I venture to assume the following:—

1st. That 2,000 yards may be taken as the extreme effective range for the commencement of an action between modern ships at all equally powerful, the percentage of hits (theoretically) being at this distance only about 20 per cent.

2nd. That ramming tactics will be universally adopted.

3rd. That one side will take the initiative of the attack, forcing the other side to act entirely on the defensive.

4th. That the attack may be considered usually to have the advantage. In stating these four points I pre-suppose the contending vessels to be fairly equal in power.

In Diagram 5 I show two vessels, A and B, both 300 feet in length, at 2,000 yards' distance, the ship B being supposed to be armed with the Lay torpedo; the dark line is the circumference of a circle which has a radius of 1,500 yards, and the dotted one that of a circle with a radius of 1,000 yards. The space within the outer circumference represents the area capable of being defended by B's Lay torpedoes. Taking the speed of this arm to be 12 miles per hour, any point on the outer circumference can be reached by it in 4·3 minutes, and any point on the inner circumference in 2·8 minutes.

The ship A at a speed of 12 knots would reach the outer zone of B's Lay torpedo in 1·2 minutes. The dotted lines branching from A, each 500 yards in length, show roughly the directions that can with any accuracy be given to A's Whitehead torpedoes, supposing A to be able to fire those weapons right ahead and astern, as well as on the beam from upper deck carriages when proceeding at the speed of 12 knots.

The Lay ship or boat torpedo will be only some 18 feet in length, and have only a maximum diameter of 14 inches; it will carry an explosive charge of 100 lbs. of dynamite, and 1,500 yards to 1 mile of cable. Its speed will be at least 14 miles, but in this paper I have only supposed it to be 12 miles per hour.

Diagram 6 represents the tactics supposed to be pursued by the Captain of ship B, armed with the Lay torpedo, in single combat with ship A, armed with the Whitehead; the vessels in other respects being fairly equal, and each steaming at the rate of 12 knots per hour. On sighting one another B would allow A to take up the best position for ramming (which is some two points off B's bow) and initiate the attack; B stopping her engines at 3,000 yards' distance from A, and starting her first torpedo: in 2·8 minutes the torpedo will have reached point T, and the ship A the point A¹: B will then proceed ahead at 12 knots, and in 1·3 minutes will reach point B¹, when the torpedo will strike A at point A²—B being then 925 yards from A². Should some unforeseen cause prevent the first torpedo from hitting A, it will be instantly fired at will, and a second torpedo started: the effect of 100 lbs. of dynamite being suddenly exploded close to A, will most probably cause that vessel's helm to be put hard over, thus offering to the second torpedo a much larger target, when it reaches A, which it will do before that vessel has turned through 90°; also B, under these circumstances, will have the very best opportunities afforded for ramming A, as she will, by turning towards her, obtain what is theoretically considered the position of greatest danger, viz., immediately behind A. During the whole of the engagement, B will present her bow only to A.

Another method of attack may be adopted by B, which is, to send out two torpedoes, the second being started one minute after the first

one, and therefore, remaining 352 yards astern of that one; so that when the leading torpedo has reached A², and hit the ship A, or been exploded at will—the other one will, one minute afterwards, strike A.

I have here only exemplified one particular case, the time allotted me for this paper not allowing of my attempting more now; and I can but believe that in future naval wars, single ship actions will most often occur. At the same time, it is not difficult to understand what a strong defence two ships armed with the Lay torpedoes would have, one of which would be sent out 1,000 yards in advance of each vessel, against an attack by two or three ships: the disabling of only one of the attacking force would so seriously disconcert the tactics of that side, as to afford the defenders the most advantageous position. Also in an engagement between two squadrons composed of several ships, supposing the leading vessels of the B squadron to have thrown out each a Lay torpedo, 1,000 yards in advance, and the other squadron to be allowed to take the initiative of the attack, the victory would seem almost a foregone conclusion for the B ships. Again, it might occur in a single ship action that the A ship, having by far the heavier artillery, and by possessing the greater speed, may force B to an encounter, during which at long range a lucky shot from B may so damage A's steering gear or her engines, as to render her helpless; but due to the power of A's guns, B may hesitate from closing her sufficiently to deliver a ram attack or fire her Whiteheads, but B, being able to take up any desired position, 1,000 yards or more from A, could by the aid of her Lay torpedoes have that ship completely in her power. Numerous other instances might be cited of the advantages of the Lay torpedo armament for ships of war in naval engagements, but time unfortunately prevents me from so doing.

I will now take the action between the Peruvian monitor "Huascar," and the Chilian ships the "Blanco Encalada" and the "Almirante Cochrane," for the details of which I have availed myself of Lieutenant Madan's instructive paper on the "Incidents of the War between Chili and Peru," which is published in the Journal, No. CXII.

The object of the Chilian Admiral was to drive the "Huascar" to the north by means of his three slowest ships, and intercept her with his fast ships, which were duly waiting some miles to the north of the coast where the Peruvian monitor was known to be lying off. These tactics proved successful, as at daylight on the morning on the 3rd October, 1879, the Captain of the "Huascar," after being chased all the previous night by the "Blanco" and her consorts, discovered the "Cochrane" and the other Chilian ships off his port bow: Captain Grau at once decided to trust to his (wrongly supposed) superior speed, and escape to the north-east: as it happened the "Cochrane," having been docked and cleaned shortly before this cruise, really was about 1 knot faster than the Huascar.

Diagram 9 shows the position of the two ships at 9.25 A.M., when the action commenced by the "Huascar's" opening fire at 3,200 yards' distance.

The "Cochrane" reserved her fire until she had reached a position

somewhere between A^3 and A^4 , distant about 700 yards from the "Huascar." For thirty minutes an artillery duel was maintained between the two vessels, when a shell from the "Cochrane" entered and exploded in the "Huascar's" conning tower, killing Captain Grau and disabling the steering gear, from which time it may be said the capture of the "Huascar" was never in doubt.

Now supposing the "Huascar" to have been armed with the Lay torpedo, and allowing the same tactics to be adopted by the two ships—then having arrived at H^1 , distant 1,350 yards from A^1 , the "Cochrane's" position at the same time—(the latter steaming at 11 knots, and the "Huascar" at 10 knots), the "Huascar" would start one of her Lays, heading it well in advance of the "Cochrane." About one minute afterwards, the ships being respectively at the points H^2 and A^2 , 1,000 yards distant, a second Lay would be started. At A^3 , the first torpedo would have hit the "Cochrane," she at that instant being some 760 yards from the "Huascar," and therefore, according to the "Cochrane's" commander, not within effective range of his 9-inch muzzle-loading guns.

The second torpedo, in the event of the first one not effecting sufficient damage, would strike the "Cochrane" at point A^4 , some 660 yards from H^4 , the "Huascar's" position at that moment.

The escape of the "Huascar" from the Chilian fleet was assured if the "Cochrane" had been destroyed or even crippled.

But if the "Huascar" had been actually armed with Lay torpedoes, and with her superiority of speed over the "Blanco," which vessel when the action commenced was some 4 miles astern, as well as with the well-known desire of the Chilian Admiral to capture her, she would have been steered so as to get within 1,500 yards' range of the "Cochrane" in the quickest time, and then attack the "Cochrane" with her Lay torpedoes, which point would be reached in about three minutes, and the "Cochrane" would have instantly the "Huascar" altered course, also turned to meet her.

The action between the "Shah" and "Amethyst" and the Peruvian monitor "Huascar" may also be quoted in illustration of the value of the Lay torpedo armament for ships.

Here, though the "Shah" was immensely superior in speed to the "Huascar," yet, owing to the great time required to turn her as compared with that vessel, her commander dared not close sufficiently to use the Whitehead, fearing the "Huascar's" ram. But had the "Shah" been armed with Lay torpedoes, she could have run up to within 1,500 yards, started her first torpedo, and then, turning, have enticed the "Huascar" to follow and run on to the torpedo, a second one having been sped in the same direction at a short interval after the first torpedo.

There yet remains to be considered the tactics to be resorted to by two ships, both of which are armed with the Lay torpedoes.

In Diagram 8 I give an example of one phase of this question. A and B having sighted one another at a considerable distance, B so manœuvres as to give A the point of vantage at 2,000 yards' distance; that is to say, allows A to believe that B is the slower of

the two in speed and desires to escape. When A is 2,000 yards astern B starts his first torpedo and proceeds away from A at a speed of 10 knots, starting a second torpedo off at point B¹, half a minute afterwards. Then A, chasing B at the rate of 11 knots, will reach A¹ at the same time as the first torpedo, and when B has reached point B², the latter vessel being then some 1,900 yards from A; if A succeeds in evading the first torpedo, the second one will strike her at A², about half a minute afterwards.

In concluding this part of my paper, I must express my extreme regret at having been forced to curtail it to such an extent that I have been unable to do little more than generalize on the tactical position of the Lay locomotive torpedo as a ship weapon of the future.

I will now proceed to the last section of this paper.

SECTION III.—*The Lay Torpedo considered as a Function of Torpedo-Boat Attack and Defence.*

A war between some of the principal naval Powers must happen before the proper development of torpedo-boat warfare can be attained (though God forbid that such an opportunity may ever be afforded us!), and therefore, though some faint rays of light may be considered to have been thrown on this part of naval tactics by the Russo-Turkish War of 1877, and the Chilo-Peruvian War of 1879, yet from a practical point of view the rays are too faint to be of much actual value; therefore here, as in Sections I and II, the deductions arrived at must be taken as little better than theoretical.

At the present time torpedo-boats are armed with either the McEvoy duplex spar or the Whitehead fish torpedo, or a combination of the same. Torpedo-boats will be employed either for the offensive defence of harbours or for the destruction of an enemy's ships anchored in their own ports, or carried by ships for auxiliary attack and defence in naval combats on the open sea.

The duty of harbour defence torpedo-boats will be chiefly the constant attack of a blockading force, for the purpose of raising the blockade or for preventing the maintenance of a sufficiently effective, or, as it may be termed, "legal" blockade.

As regards the attack of anchored ships, such opportunities should be conspicuous for their rarity, and in the event of a vessel being forced to anchor in any position open to such an attack, every ordinary and extraordinary means should be taken to render it impossible for hostile torpedo-boats, armed with the Whitehead or spar torpedo, to get within effective range, and a most complete boat-patrol should be instituted.

Rarely indeed will such chances be offered for torpedo-boat attacks as were given to the Russians in their late war with Turkey; for instance, three Turkish ironclads anchored off Sulina, completely unprotected by patrol-boats, booms, or nets; a single ironclad anchored at Soukoum Kaleh, alone protected by boats rowing guard around her; and again several ironclads anchored head and stern in Batoum, guarded by a few boats, and with an advanced barrier of booms and

planks, which means proved ineffectual, as the Russian torpedo-boats evaded the first, and their torpedoes the latter protection. The failure of this and the greater portion of the Russian torpedo-boat attacks were due, not to the means of defence employed by the Turks, but generally to the want of continuity in carrying out the attacks on the part of the Russians, and also to the uncertainty of the Whitehead and towing torpedoes used for the first time in actual war and by men not thoroughly acquainted with their manipulation.

The carrying of torpedo-boats by the larger class of men-of-war is principally for the purpose of attacking disabled ships in an action on the open sea. The idea is that these boats should be lowered before the action, and be towed or follow astern of the ships, from which position they should be prepared to dart out and attack or deter any ship attempting to ram, and also to attack any of the enemy's crippled vessels.

The question that here naturally suggests itself to a practical mind is whether, when required, these ship-torpedo-boats would ever be found to have escaped scot free from the large and small missiles of the enemy's guns.

Having thus briefly sketched the more important work to be performed by torpedo-boats, I will now endeavour to show the value of the Lay torpedo for this service.

The Lay torpedo for boat service would be 18 feet long, and would carry 100 lbs. of dynamite and 1,500 yards to 1 mile of cable with a speed of at least 14 miles per hour.

Each of the first class or sea-going torpedo-boats built expressly for harbour offence or defence would be armed with two Lay torpedoes. The advantages of this form of armament are—

1st. The great distance at which the attack may be made, combined with almost absolute certainty of hitting.

2nd. The perfect freedom of action afforded the torpedo-boat; that is to say, with the Lay armament the torpedo-boat can manœuvre at her highest speed in any direction required. With the Whitehead armament the speed of the torpedo-boat would have to be very considerably reduced, and her head pointed in the proper direction before discharging her torpedo.

3rd. Great simplicity in manipulation, as it is not necessary to know the rate of speed at which the attacked vessel is moving, nor her distance off, nor has any calculation to be made as to the rate and direction of the current, if there be any; all of which has to be done when using the Whitehead, and is exceedingly difficult to estimate at all correctly at night, and any of which may materially affect the chances of a successful shot with that weapon.

4th. The simplification of the construction of torpedo-boats, due to there being no discharging apparatus, either guns or tubes, needed with the Lay.

Take the case of the larger type of torpedo-boat built by Messrs. Thornycroft and Co. and Messrs. Yarrow and Co. These boats are constructed to carry four of the large 15-inch Whiteheads, 19 feet

long, and nearly one-third of the interior space of these boats is taken up by the torpedo-rooms and discharging apparatus and tubes.

Then, in constructing torpedo-boats which are to use the Lay torpedoes, it is only necessary to enable them to hoist up a couple or more of such weapons, utilizing all the space rendered free by the non-requirement of torpedo-rooms, discharging apparatus, tubes, and guns, to more effectively protecting them against machine-guns, and affording them a larger coal capacity; this refers more particularly to the sea-going torpedo-boats.

5th. The great power of the Lay, due to the large charge carried by them.

Then, in making an attack with torpedo-boats armed with the Lay torpedo on a blockading ship, the time chosen would be either the dusk of the evening or just before daybreak. In this case great darkness is not so essential as it would be when using the Whitehead, when the boat must approach comparatively very close to the ship, and also remain there during the time required to fit and discharge her torpedo. The tactics to be observed would be for the boat to advance very carefully to within 1,500 yards of the ship, and then start her Lay torpedo, which would take about three minutes to reach the vessel. At this distance in the dusk or early morning there would be very little chance of the boat being discovered by the enemy, but if that happened she would at once be steamed away from the ship.

All vessels using the Lay would be provided with an extra electric cable, similar to and coiled in precisely the same manner as described for the torpedo cable, so that by connecting these cables up, the vessel might move at any speed in any direction without dragging out the cable in the torpedo, or otherwise interfering with her manœuvring.

Though the electric light brought to bear on the torpedo-boat at that distance might possibly discover her, yet her variable and considerable distance, also constant changes of direction, would offer little chance to the ship's guns, at the same time the electric light would show up the ship more distinctly to those in the boat.

It must be borne in mind that the Lay torpedo keeps a very direct course when uninfluenced by strong currents for a considerable distance; neither sea nor wind causes it to be deflected.

If the vessel is known to be protected by nets, then both torpedoes would be sent out, one following closely behind the other.

Another plan of attack, which seems to me to possess great chances of success, is for the fast torpedo-boat to tow out a small rowing-boat, and when within 1,500 yards distance from the ship, drop the boat and torpedo, which would be operated from the rowing-boat; the torpedo-boat at once steaming away from the ship, and well clear of the operating boat; then if the electric light search out the torpedo-boat, she would so manœuvre as to keep the beam of light on her, and if possible draw the ship after her; the operator in the small boat utilizing the electric light for directing the torpedo to the ship.

There are numerous other methods of torpedo-boat tactics, but the foregoing suffice to illustrate the advantage of the Lay armament for such craft.

I will now cite two actual instances of attacks made on ships at anchor by torpedo-boats, in both of which cases, had the Lay torpedo been the weapon employed, a success instead of a failure in each instance would most assuredly have been recorded.

At Batoum, on the night of the 28th December, 1877, four Russian torpedo-boats attacked a squadron of Turkish men-of-war anchored head and stern. The night being exceedingly dark two of the attacking boats succeeded in evading the few Turkish guard-boats patrolling the harbour, and at a distance, differently estimated at from 150 to 60 yards, discharged two of their Whiteheads against a Turkish ironclad, both of which failed in their object, but were the next morning discovered high and dry on the beach, just astern of that vessel.

This latter fact proves the absence of any serious barriers in advance of the vessels, and therefore a Lay torpedo would have had a clear course.

Supposing the two Russian boats to have been armed each with two Lays, then instead of getting so close to the Turkish ships they could have remained at say some 800 yards from them, and thence, each boat having picked out a ship, started their Lays, two for each vessel, one closely following the other, so that whatever surface obstacles may have been in the way the leading torpedoes would have destroyed them, and the ones following have dashed on, and each hit and severely damaged, if not sunk its ship.

Allowing the barrier to have been placed 220 yards in advance of the ships, then the first torpedoes would have destroyed it in about eighty seconds, and the second ones started half a minute after would hit each its ship in one minute from the time of the explosion. There was a slight swell experienced on this occasion which, combined with the darkness whereby the distance could not be at all correctly estimated, and which prevented the delicate adjustments of the Whitehead being properly applied, as well as the apparatus for launching these Whiteheads not being very perfect, may be adduced as the principal causes of the failure of the attack. Further, the fact of being within 200 yards of an enemy's fleet, and in an unknown harbour, may have somewhat disturbed the highly strung nerves of those making these adjustments.

Now, with the Lay neither the swell nor the darkness, so long as the ship could be seen, would have affected its manipulation, and the knowledge of their comparatively great distance from the enemy, as well as the simple and ordinary nature of the work being executed, would always tend to allay instead of to increase any excitement of the operators.

The second instance occurred during the Chilo-Peruvian War of 1879-80. At 4 A.M. on April 10, 1880, the Chilian torpedo-boat "Guacolda," armed with two spar torpedoes on the McEvoy system, entered the harbour of Callao, and succeeded in exploding one of

her torpedoes under some booms fixed at a distance of about 15 yards from the side of the Peruvian corvette "Union," before her crew, armed and on the watch, could fire a shot. The "Guacolda" escaped without receiving any harm, and the "Union" experienced only a severe shaking.

Now, had the "Guacolda" been armed with two Lays, she might have remained at the furthest distance at which the Peruvian ships "Union" and "Atahualpa" could be distinguished, and then from there with the greatest ease and certainty have destroyed them both; the half circle of spars protecting the ships would not have stopped or fired the Lays, as, owing to the conical shape of their bows, and the submergence of their noses, they would have slipped underneath them, pushing down the guide rods only to be raised again when clear.

I have taken the foregoing incident from Lieutenant Madan's paper, and in which he makes mention of there being several foreign men-of-war in Callao harbour at the time of this attack; and, moreover, he states that the "Guacolda" nearly collided with one of them. Trusting I shall be excused for diverging from the subject of this paper, I would ask what would be the result of the destruction of a foreign man-of-war by mistake when at anchor in an enemy's harbour during a night attack, such as I have just described? It is well understood that the success of a torpedo-boat attack is mainly dependent on the secrecy with which it is organized and carried out, and therefore no warning could be expected to be afforded non-belligerents that such an affair was about to happen, and also the possibility of mistaking one man-of-war for another on a dark night is extremely likely to occur.

Time here also unfortunately prevents me from discussing other known torpedo-boat attacks which have occurred in actual war, and from showing how the failures which generally resulted from them would have been successful had the boats been armed with Lay torpedoes.

And here comes the consideration of the tactics to be adopted when making an attack with the Nordenfelt submarine boat. As I have previously stated this craft will be armed with two small Lay torpedoes and one rocket torpedo. When moving out to the attack it is intended for the boat to remain with her turret above the surface and her funnel up. On reaching a distance of 2 to $1\frac{1}{2}$ miles from the attacked vessel, her funnel will be taken in and the boat submerged until only her glass dome remains above the surface; when distant from the enemy about 1,500 to 1,000 yards, she will stop and start one of her Lays. Should this fail she will then be taken closer (800 yards distant), and thence start her other Lay; if this be unsuccessful, or if the boat be discovered from the ship, she will then be completely submerged, close to 100 yards, and then fire her rocket torpedo.

Another most important use of this locomotive torpedo would be as the armament of specially built torpedo-ships, which are intended to attack the heaviest armed ship at very close ranges, and rely solely

on their torpedoes and ram for their powers of attack and defence. The advantages of arming such a vessel with torpedoes which can be manœuvred at long ranges with absolute certainty, and which require no special fittings, are self-evident.

I have in this paper attempted to point out certain positions in which the employment of the Lay locomotive torpedoes would prove a most valuable factor of attack and defence, whether used from a ship in engagements on the open sea, or in torpedo-boat attack, or, further, as a weapon for the defence of harbours, rivers, estuaries, and channels, and trust I have succeeded in proving the value of this weapon to such a degree as to show that it is worth a practical trial.

APPENDIX.

In Diagram 9 is shown a sketch of the day trial of the Lay torpedo at Constantinople in November, 1882.

The velocity of the current was 3 miles per hour in the direction shown by the arrows.

The force of the wind (southerly) was 5. The distance between the tug boat (A) and target boats (B) was 3,648 feet, or 1,216 yards. The space between the target boats was about 90 feet.

The whole length of the run of the Lay torpedo, from the tug boat through the target boats and back to T', was 6,096 feet, or 2,032 yards. The amount of cable coiled in the torpedo was 2,420 yards, or 7,260 feet. Therefore, waste of cable, due to current and depth of water, was about 264 feet. The depth of water was 40 to 50 fathoms. The duration of the run was 11 minutes. The amount of gas in the torpedo reservoir was 260 lbs., and the amount expended was about 115 lbs.

In the night trial, made a few days afterwards, the torpedo was run the same course through the target boats, but was not brought back, as its lamps are not intended to be seen from ahead. The current on this occasion ran at the rate of at least 6 miles per hour, and there was no wind.

The torpedo cable was on each occasion made fast only to the keyboard, which weighs 5 lbs., and was not in any way secured.

Vice-Admiral GORE JONES, C.B.: With your permission, Sir, I should like to make a few remarks upon the paper to which we have just listened. During the six years that I was Naval Attaché in America, I saw the Lay torpedo experimented with fully a dozen times, and in the whole of that time I never saw a successful run. The lecturer has laid great stress on the intricacy of other torpedoes, but I think the Lay torpedo is just as intricate as any other that we know of. There are, I think, some radical defects in the Lay torpedo; one is in the power with which it is driven, viz., carbonic acid gas. In the first place carbonic acid gas starts the torpedo with great velocity, but it very soon decreases as the reservoirs empty. In the second place, carbonic acid gas is subject to the effects of temperature, and I was told, in one of the experiments, that a heated shot was put in the chamber where the gas receivers were, to keep the carbonic acid gas up to its temperature.¹ In the early experiments the cable was always kinking. At first it was reeled up, and then it was faked down, as sailors say, like the top-sail halyards; but, nevertheless, the kinking occurred and ended the experiment. In the next place, there is a good deal of danger connected with the explosive quality of carbonic acid gas, and at Rhode Island, at the torpedo station, on one occasion one of the flasks containing the gas

¹ The carbonic acid gas is put into the receivers at high pressure in a liquid form, and the expansion of the gas is very sensitive to temperature—being torpid in very cold weather and the reverse in warm. A small heated V pot therefore, placed in the compartment where receivers are, would increase expansion.

burst and knocked everything to pieces; and then, how is carbonic acid gas to be manufactured on board a ship for fleet service? It is an impossibility! Then, again, we come to the towing of the cable and velocity. I deny entirely the speed. I never saw a Lay torpedo used the whole time I was in America that went 7 knots, let alone 14, but Colonel Lay may have improved his speed in the last three years. With regard to the cable running along the ground, that I deny also. There is a very large bight left, and any fast boat with a grapnel passing across it would certainly grapple and disable it. But this is a matter of small consequence, because, if these things are to be used, the ships to be attacked are something like birds, and would not wait to have salt put on their tails, but if done when nobody is dreaming of an attack, I admit the feasibility of it, and it is much the same with all torpedoes; but when you take the case of two ships manœuvring, how in the world could a torpedo be sent out with a great bight of cable when both ships are going at any speed? It is an impossibility to send out a boat towing a long line astern to go into action against a movable enemy from a moving base. The torpedo-boat would become unmanageable and could not be directed, and I do not think any Lay torpedo was ever run where the basis of the operation was not steady. In one of the reports that I made, the first time I saw the torpedo, I said it manœuvred like a sea snake: but when we came to look at all the disadvantages of it afterwards, I came to the conclusion that it was not an effective weapon of war. There are places, such as the lecturer has referred to, where in narrow passages unquestionably it might be sent out, and might be effective; but only in those positions. I look upon the motive agency as a very great danger, because it might explode at any time through change of temperature, and to have such reservoirs in a ship would be highly dangerous. Then, again, you would require the ship to be constantly manufacturing a very dangerous chemical. It may be answered that you can use compressed air, as is done in the Whitehead torpedo, but still it has not been done up to the present time and would much shorten the effective range. I have seen a torpedo sent out at night, and very fairly guided, but then it was sent from a fixed position in a known direction, and the whole thing might be done by compass bearings. That could never be so in actual war; therefore, I think a great deal more will have to be shown to make the torpedo a vessel that is at all likely to be useful in the general service afloat; but it might possibly be effective, provided only the attacking force was not aware there was any Lay torpedo likely to be sent out against it.

Captain DOTY: I have given this subject of moving torpedoes some attention for the last twenty years, having been one of the first to bring it to the notice of this Government. I have listened to the remarks of the distinguished Admiral on the other side, and I gather from what he has said, that the Lay torpedo must be worked solely from a fixed base. Taking into consideration the remarks made with reference to the torpedo-boat, I understand that the Nordenfelt boat is unlike anything that has hitherto been produced. It is a boat capable of being submerged and stopped at will. It may be run out into a bay and there stopped, and the torpedo, which is fastened alongside, may be detached and sent on its mission while the submarine boat remains as a base of operations. I conceive this to be a very valuable auxiliary for the defence of harbours and roadsteads. I have seen the Lay torpedo in America. I was on board the "Alarm" when it was experimented with; I have noted some of the improvements that have been made, and after the recent experiments made at Constantinople, I feel justified in making a bold prediction and prophesying that the Lay torpedo will yet be the leading arm of defence for the protection of harbours and roadsteads in conjunction with the submarine boat from which it is proposed to work it.

Captain MACLEAR, R.N.: There are many other Officers present who have studied this subject far more than I have, and I only ask for information on one or two points. The advantages claimed for this torpedo make it a most formidable weapon; but one point that struck me during the reading, was whether this was a real torpedo, or merely a theoretical one; because one would like to know more about the details. I have not quite understood whether its cable is carried out in the torpedo and paid out as it goes along, or whether it is paid out from the ship or discharging point. If the latter is the case, I have no hesitation in saying that no

boat, of whatever speed, can manœuvre whilst towing a cable. The extra cable that has been spoken of to be supplied on certain occasions would, I take it, have to be towed, and that, as Admiral Jones has said, would render the torpedo perfectly useless.

Lieutenant SLEEMAN: There is no towing at all. Whether the ship is moving, or the torpedo moving, a child three years old can hold the cable in his hand; there is no drag whatever.

Captain MACLEAR: I should like to know how the supply of carbonic acid gas is to be carried, and whether the torpedo is to be kept charged with it, in fact, where the torpedo is to be charged, and how? Also, what would be the effect of a shot striking the carbonic acid gas chamber, because if it is only made of $\frac{1}{8}$ -inch iron it is penetrable to rifle shot.¹

Mr. QUICK, R.N.: The objections to the Lay torpedo have been so well stated, that I will not go into the question, further than to say that it appears to me that, like everything else, it has its valuable side and its useless side. I do not see my way at all to its use in deep-sea fighting, though it is possible it may be useful for harbour defence. The great objection to this torpedo is want of speed, that the propelling power would soon be exhausted, and consequently would not carry the torpedo the distance necessary in cases where both ships are moving at a considerable speed. It has been said that there would be no drag on the cable. Now I am quite prepared to admit that there would be no drag when the ship from which the torpedo is discharged is stationary; but I do not think it is possible for the ship to be moving, from which the torpedo cable is paid out, and yet to have no drag on the cable and key-board. It seems to me utterly impossible. We all know how much strain there is upon log lines towed from a ship's stern, and, however you make the cable, if your torpedo discharging-ship does not move directly opposite the Lay torpedo, you will have a most tremendous strain. In the other case where the torpedo-ship is quite stationary there is no strain at all; so that although as regards fleet actions or deep-sea fighting the Lay torpedo is altogether out of the question, it has very valuable qualities for harbour protection. The point I would wish to urge is the great speed that should be possessed by all locomotive torpedoes. We talk of ramming. Ramming, of course, is a very fine thing; but if you have a torpedo which you can discharge from your bow at a speed of say 30 or 50 or 100 knots an hour, what, then, is the use of ramming? I cannot see it. But it is said that it is impossible to have this enormous speed. Twenty years ago, the idea of having torpedoes to go 15 or 16 knots seemed almost absurd; but the absurd of to-day is the possible of to-morrow. We all know now that torpedo-boats can go 20 knots. The Whitehead torpedo has gone 29 knots, but had we said that twenty years ago, we should have been laughed at. I believe myself it is quite possible for the speed to be very largely increased—when I say very largely, I mean to say that by means of rocket composition you will get at once the greatest power possible. When you want an immense power in a small compass, you must fall back upon rocket composition. It is an old idea, but it has never been properly worked out. I hope and believe that it eventually will be. There are people in Russia, in Germany, and, I believe, in this country, who are working at this point, and it is in the development of that idea that you have the future torpedo for deep-sea fighting, fleet against fleet, and ship against ship. But you also have another thing. I see very clearly that you will have to have flying torpedoes, in the shape of torpedo shells carrying an enormous explosive charge through the air. I do not come here to discuss my own inventions in this matter, but only to point out the possible future and the limitation of the Lay torpedo for deep-sea fighting. The present explosive charge of the Lay torpedo is said to be small; but small as it is, it is quite sufficient for its purpose if you strike the ship in a vital part. I say again that

¹ A great deal of experience in sounding at all depths, from ships and boats, with varieties of lines, has taught me that the resistance of water is very great even to bass pianoforte wire; and that to medium line which would be about the size of insulated wire, water acts almost as a solid the moment the line is drawn aside out of the straight course. The diagram only represents the position of the line if the boat remained stationary, the curve would be very different were the boat in motion.

the fighting torpedo for fleet actions, ship against ship, must be looked for in the rocket torpedo, as has been mentioned by the lecturer; for I know that the range can be increased very largely, and a speed attained of more than 100 knots an hour, and high speed ensures accuracy.¹

Mr. NORDENFELT: The lecturer has mentioned the submarine boat that I am building. This, however, is certainly not the time to speak about it, except to say that for anything like a boat which attempts to go down in the deep water, a Lay torpedo seems to be exceedingly useful, because I require no machinery for ejecting it. Admiral Jones saw the Lay torpedo in America when it was a baby. Now I dare say that our President has more experience than most of us as to guns and other things, which, when they first come to light, are full of childish illnesses, but afterwards turn out to be useful. I fancy it is the same thing with this torpedo. The figures given are against Admiral Jones, because he supposes that you cannot succeed in going anything like 14 knots. The Russian torpedo-boats are very near this, as they have gone over 12 $\frac{3}{4}$ knots. The torpedo may therefore be considered very nearly full-grown. There is one point to which it is especially important to draw attention, namely, the question of loss of wire. Now I do not know anything about fleet actions; but if the torpedo is used for port or coast defence—say for instance at the Bosphorus—as long as the water is shallow, the wire of this small calibre must necessarily sink rapidly to the bottom. As a matter of fact, at Constantinople when the wire was picked up it had fouled at the bottom. Anyhow, the wire being held at one end, in the first instance by the shore end, and afterwards by the friction of the bottom of the sea, and having no strain on it where it is paid out of the torpedo itself, there is not the slightest doubt but that it must sink very quickly with its specific gravity of 1.6. The loss of wire is consequently only slightly more than the actual depth of water at Constantinople, this loss was barely 200 yards, and considering the great depth of the Bosphorus, there is not the slightest doubt that you would lose very little elsewhere.

If the wire goes down to the bottom, I presume you cannot grapple on the bottom; therefore in shallow water the enemy could not take it up. If his torpedo-boat were to run very close to the torpedo, and try to keep up with her, it would have to run up very quickly, considering that it would have to come from a certain distance. The enemy's boat would have to put the spar down for grappling, and could not steer with anything like a spar held down into the water. If the Lay torpedo were discharged from the torpedo-boat, the enemy's torpedo-boat would have to show a broadside towards the torpedo-boat which discharged the Lay, and I doubt whether any torpedo-boat, at such a short range, would like to face machine-guns firing at her broadside from my own torpedo-boat. I do not believe that the enemy's torpedo-boat would try to pick up the Lay torpedo, knowing that the operator could at will discharge it at any given moment. If a ship came up the Thames to Woolwich, or down the Bosphorus, and had torpedo-boats with her, then the operator, seeing the torpedo-boats of the ship coming down, would send his torpedo with the guide-rods down, only turning them up now and then to see where it was, until it had reached the point where he expected the ship to pass, and no grapple could possibly then be effective to prevent the torpedo running in. Furthermore, if the wire were grappled—the worst thing that could happen—it would not stop the torpedo in any way; the only result would be that the controllable Lay torpedo would become an

¹ As to the possibility of attaining a very high speed by means of rocket composition it may be mentioned that a 24-inch rocket torpedo can be constructed to exert a propelling energy for eighteen seconds equal to 3,100 I.H.P. The propelling energy of a 15-inch rocket torpedo would be about 1,360 I.H.P.; and that of the 12-inch rocket torpedo would be 760 I.H.P. The propelling energy of the old pattern 16-inch Whitehead torpedo was only about 3 $\frac{1}{2}$ I.H.P. and speed 8 knots; that of the newer pattern 14-inch Whitehead torpedo is from 9 $\frac{1}{2}$ I.H.P. to 18 $\frac{1}{2}$ I.H.P., giving a speed of 19 to 25 knots. That the probable speed of a properly constructed rocket torpedo will be very great is therefore evident. But it is to be borne in mind, that the efficiency of the rocket composition for propelling purposes depends entirely upon the method of its treatment, and in the minute detail of its arrangement.

uncontrolled torpedo, like those of other systems, and would continue running its course, though without further guidance from the operator; therefore, if it can get within a couple of hundred yards of a ship before it can be grappled, it still would retain the same chance of hitting as any other torpedo would have at that distance. It would, perhaps, be right for me to state that, probably, neither my guns, nor any other machine-guns, can fire with effect against a torpedo running 10 inches below the surface of the water, nor can we hit any other torpedo submerged. The object of the guns is more to fire against the boat from whence the torpedo is discharged, and the Lay torpedo will, on this point, offer this advantage, that it could be started at a greater range than others, and the calibres of machine-guns might have to be increased for firing at such long distances.

Captain CROZIER, R.N.: I have been advocating, for some time, the principle of having fore and aft bulkheads and watertight compartments; so that if the torpedo struck one part of the ship, the ship would be kept afloat by those bulkheads. My idea is to have an iron bulkhead from stem to stern, combined with watertight compartments, so that although one part of the ship may be injured, still the other would not sink. I think if that principle was adopted in our merchant service, many ships would be saved.

Captain McEVoy: I regret that we have no record of any very important experiments that have been made to demonstrate how far nettings are really a protection to ships. It strikes me that the explosion of a charge of 150 lbs. of guncotton or dynamite against the nets of a ship which was under weigh, for instance, would destroy the whole fabric of the netting and booms, and everything on that side of the ship, and there would be no protection against other torpedoes that might follow immediately after; not only that, but the dangling fragments of the disrupted netting would be swept astern and in all probability foul the screw. I do not think it is probable that a vessel would carry two sorts of netting, one against torpedoes, running near the surface, a shallow netting; and the other, a deep netting, for the reason, that when they had out the shallow netting as a defence against the Lay torpedo, they might be attacked by deep running torpedoes, and, consequently, it would be absurd to suppose that they would carry two sorts of netting, not knowing which to use. The principle of the Lay torpedo has always been a fascinating one to most men interested in torpedoes, and I think it is regarded as a very important one. I know that the early record of the Lay torpedo is not a very good one; but yet, the same may be said of nearly all inventions. We can scarcely find anybody at present who will acknowledge that he was ever opposed to breech-loading firearms, and yet we know that they were kept out of the Service for years after they had reached a very considerable degree of perfection. The Lay torpedo, from what I know of the improvements in progress, has, I venture to say, a future which will be quite the reverse of the past, and I think a little time will demonstrate that fact.

Captain CURTIS, R.N.: I came to the Institute this afternoon with the idea of finding fault with the cable, but Lieutenant Sleeman seemed to say that it paid out so rapidly off the reel that it sank at an angle of 45°, and of course, in that case, there would be some difficulty in grappling it. I think, however, that a torpedo weighing 1½ tons is no baby to handle quickly in a boat. One of the great features to be admired in it, is the relative specific gravity of the torpedo, keeping it within a certain distance of the surface. I think, however, there has been some error with respect to ships forcing a passage, and that under such circumstances, the ships will go two or three abreast with a swarm of torpedo-boats and Nordenfelt gun-boats covering them. Now I should not like to do Mr. Nordenfelt the injustice of saying that his gun would not penetrate one of these torpedoes under water; for I think the result would be that in all probability the torpedo would lose her specific gravity and go to the bottom. Probably with the very good look-out which they will have in some of these new ships where they have 8 or 9 Nordenfelt guns on the broadside, if the men cannot see these guiding rods they ought to be ashamed of themselves, and I should do Mr. Nordenfelt's gun considerable injustice if I thought that it would not sink one of those Lay torpedoes only immersed 9 inches. I believe his guns are intended to penetrate and sink torpedo-boats; therefore, after all, the great feature in the Lay torpedo is to establish what we commonly

call a "funk;" that is to say, they will be used in narrow passages, and there, no doubt, your practice ought to depend upon the moral courage of the Officers of the fleet, or the Captains of the ships attacking a port.¹ Carbonic acid gas is a very dangerous thing, and, as Admiral Jones says, I should not like to have the trouble of manufacturing it on board ship. I have, therefore, come to the conclusion that this torpedo is not adapted for use in the deep sea, but that it is adapted for narrow passages more to create a fright than for anything else.

Captain F. HARVEY, R.N. : I should like to say one or two words about the Lay torpedo. I happened to be in Peru at the time of the late war, and perhaps, having been on the spot, I could give you a direct account as to what took place with the "Huascar." The "Huascar" had a Lay torpedo on board before the last action, and it was entirely through the mismanagement of the person in charge that the torpedo did not prove of service in that action. The torpedo was in command of Colonel Chester, who was not considered by Colonel Lay to be skilled in the management of the torpedo, otherwise, I think it would have proved a success out there, and would have saved Colonel Lay a good deal of trouble now.

Captain MARKHAM, R.N. : It is not my intention either to criticize or discuss the merits or demerits of any of the motive torpedoes which have been alluded to by the lecturer to-day. I simply wish to say a few words with reference to what the last speaker has said. The lecturer implies, if he has not absolutely asserted, that had the "Huascar" been provided with the Lay torpedo when she was fighting the "Cochrane," a different result to the action would have been recorded. The last speaker has informed us that the "Huascar" was, prior to the action, provided with the Lay torpedo, and I would wish to state that there was also a duly accredited agent of Colonel Lay's specially sent on board that ship to manipulate the apparatus, and also for the purpose of instructing others in its use. This Lay torpedo was used in the roads of Autofagasta on the coast of Bolivia, when Captain Grau attempted with it to destroy the Chilean corvette "Abtao" lying at anchor in the bay. On the discharge of the torpedo, however, it is reported to have turned straight round, and to have come directly towards the ship from which it was fired, thereby imperilling the safety of the "Huascar." The danger was only averted by one of the Lieutenants pluckily plunging overboard and deflecting it from its course. This failure was the real reason why the "Huascar" was unprovided with the Lay torpedo when she fought the "Cochrane." The only motive torpedoes the Peruvian Government possessed, of which we have any knowledge, were the Lay. There was undoubtedly a motive torpedo, and presumably a Lay sent out for the purpose of destroying one of the Chilean blockading ships off Callao, but, either through some insufficiency of wire, or derangement of the adjustments, it exploded, or was exploded before it reached within a third of a mile of the ship that it was destined to strike. I know the Peruvians had several Lay torpedoes in their possession, but for all the use they were, they might just as well have remained in the United States. There is one other point I would like to refer to. The lecturer has said "that although the 'Shah' was immensely superior in speed to the 'Huascar' when she fought her memorable action with that ship, yet, owing to the great time required to turn her as compared with a short vessel, her commander dared not close sufficiently to use the Whitehead." Now, as a matter of fact, the Whitehead *was* used, but, it must be remembered that it was one of the early pattern Whiteheads only possessing a speed of about 8 or 9 knots. The "Huascar" had therefore very little difficulty in avoiding it.

Lieutenant FASCE : The last speaker has only corroborated what I said as to the Lay torpedo being mismanaged on the "Huascar" before the action. If they had succeeded in managing the torpedo at that time, there is no doubt that the "Huascar" would have had the Lay torpedo to use throughout the remainder of the war, because Captain Grau intended to have it.

The CHAIRMAN : We have had a very interesting lecture and a very good discussion, and, seeing that the time is so far advanced, I shall offer very few remarks. In the first place, the lecturer has not mentioned one torpedo of recent

¹ I believe there are many ways of diverting and arresting torpedoes in their course, independent of the ship's netting.

invention, that is the Berdan ; perhaps he can tell us something about it. I have heard it mentioned as a very promising one ; one remarkable circumstance is the slight progress that has been made of late years in the manufacture of torpedoes. It is ten or twelve years since the Whitehead came to the front, and the original ones are still under certain conditions very good weapons. It is not worth while for mechanics and scientific men to waste their time and money in experimenting on an implement that is scarcely of marketable value. That is one reason why torpedoes have not been developed more than they have been up to the present time. I am pretty well acquainted with the Whitehead, but I confess as to the Lay, I know nothing about it. As a sea torpedo to work from a moving base, I do not see that it can be applied practically. I do not see how it is possible, with one ship going one way and another another, that a torpedo is to be steered by the first ship so as to strike the other ship, the vessel actually steering it going on a different course. I have had some little experience in steering boats electrically, both in the day time and at night, and I found there was great difficulty in steering the boat after she had gone a certain distance. The only time when she could be steered with certainty was when the observer was directly astern. I have no doubt the steering apparatus is very greatly improved since then, but at the same time, I do not think you can steer accurately beyond a very few hundred yards. You can only steer a thing as long as you can see it, and to put up two pickets, or to put two lamps very close to each other, and to manipulate the steering by them at any distance, appears to me to be quite impracticable. I can see a use for the Lay in narrow waters from shore, or from a fixed base ; but I cannot imagine its being used successfully from a moving base, or being regulated and controlled when the ship from which it starts is herself manœuvring. One or two statements have been made about the Whitehead, in which I do not think the lecturer has given that torpedo quite sufficient credit. He said the highest speed attained was 26 knots. Mr. Quick said 29. I had never heard of that, but I knew that it had attained a speed of 27 knots, and I have no doubt the speed of the Lay may have increased in the same proportion since the earlier trials. The lecturer says, "Practice with this torpedo by men who are not experienced would not be attempted on a vessel going at a greater speed than 10 knots." Now from my knowledge, I think that no one except experts could possibly hope to succeed with any description of torpedo, not only the Lay, but any other. A friend of mine, well acquainted with torpedo work, a short time ago made the observation with reference to the Whitehead, which I do not think is more complicated than the Lay, that to make it a success you must "love it ;" that is, you must be always working at it. You must understand it inside and outside. It is like a mother and her child ; practice once in three months will not do. No one but experts, by which I mean persons specially trained, must ever be put to carry out torpedo work. I will not detain you further, but will ask the gallant lecturer to reply to the questions that have been put.

Lieutenant SLEEMAN : In answer to the attack that has been made on the Lay, I would first like to ask Admiral Gore Jones as to the date when he saw these trials.

Admiral GORE JONES : I saw the trials on several occasions under the most favourable circumstances for about six years. I went to America in 1873, and left in 1879. I saw a dozen trials under the most favourable circumstances with the inventor there. I went long distances to see them, and always had to return home without having seen anything really effective.

Lieutenant SLEEMAN : In answer to Admiral Gore Jones I can only say that the Lay torpedo has been much improved during the last few years, for he states that the earlier trials were generally unsuccessful, whilst from 1878 the Lay trials have been attended with uniform success. I have personally seen it run as I have described here, and it was most successful ; and I do not think any doubt can possibly be thrown upon my word, one who has had a great deal to do with electrical apparatus of every nature. I must say I have never seen, and I do not believe it would be possible to imagine, anything more simple than the electrical mechanism by which the torpedo is controlled. As regards the speed of 14 miles, I never intended to say that the Lay had a speed of 14 miles. Colonel Lay is a gentleman who does not like to say what *can* be done, but only what *has* been done. I have seen the Russian official reports of the trials in 1879, 1880, and 1881, of the trials with ten

of his torpedoes, built by Colonel Lay in Russia, one of which ran three-quarters of a mile out, and three-quarters home in 7 minutes 58 seconds, which is at the rate of $12\frac{1}{2}$ miles per hour. That is a fact, which, no doubt, the Russian Attaché will vouch for; I have, therefore, in my lecture, taken the speed of the Lay as 12 miles per hour. The speed of the one that ran at Constantinople was only 8 miles, as I said, the one that is now building, I expect you will find has a much greater speed than you seem to anticipate. Admiral Gore Jones seems to imply that the cable will sink; I do not see how anybody could say that, after my stating from personal experience that the Lay cable, in 50 or 60 fathoms of water, was on the bottom and broke there, causing us to lose a portion of it, in our day trial at Constantinople; therefore, there can be no doubt about the cable sinking. As regards the danger attendant on using carbonic acid gas, I remember, not long ago, a very serious accident happening at Portsmouth during the compression of air for a Whitehead; still the Whitehead is being used. Our new breech-loading gun burst the other day, but I believe we are still using breech-loading guns; boilers have burst very often, but still there are steam-boats. My experience of the manufacture of carbonic acid gas enables me to declare its freedom from danger, and its exceeding simplicity of manufacture. It has never been intended, however, to make this gas on board ship. Each torpedo would be supplied with two, three, or four spare filled reservoirs. As regards the storage of the gas, a reservoir was discharged at Constantinople which had been partially filled three or four years, and the gas was in perfect condition. The gas is only put into the reservoir at a pressure of 800 to 900 lbs. and the reservoirs are tested to 1,600 lbs.; therefore, I think, as far as the gas is concerned, there need be no mistrust. I have tried to explain about the cable as clearly as possible, but it seems to puzzle everybody. Hobart Pasha would not believe that there was no drag on the Lay cable until he saw it himself. He is a difficult man to convince, but he *was* convinced after witnessing the trial that the cable offered no drag whatever. It is reeled on a reel, and when the reel is full a thin iron jacket is placed over it, and the core of the reel is removed, leaving a cylindrical coil of the cable. There is not the slightest possibility of a kink in that cable, as Colonel Lay does not use the reel now. In his old torpedoes he reeled it and unreel it as he went ahead, but he now takes the reel away and leaves the core. In Belgium he ran this torpedo twice, in Russia once, and ten other new ones; in Constantinople he has run it twice in my presence, and in China twice, and on no occasion has there been any kinking of the wire. Captain Markham says an expert was sent out with the Peruvian Lay torpedoes; I should like to ask whether it is likely that a foreign Officer, who might be considered an expert, would be got to go and fight for a foreign country against another country that he did not care a rap about? *We* know perfectly well that the gentleman who went out there was not an expert. The torpedo was on one occasion tried, and it was supposed to have turned back. It is very easy to understand that. The key was probably put over to "port" or "starboard" (the torpedo turns very quickly), and she would probably turn round quicker than those unacquainted with her manipulation expected, forgetting the *key* was hard over, she was slewed round and came towards them, and they forget to turn the key off in their excitement. In the action between the "Huascar" and the "Cochrane" no Lays were used. It is of no use for any country or Government to buy the Lay, or any other torpedo, if they do not take the trouble to learn how to use it. The Chairman says experts are required. As regards the Lay I do not think an expert is required unless you call a sailor-man an expert. I do not call him an expert. I would go on board any ship you like, pick up a first-class boy, and he would work the Lay just as easily as I did. As regards the Berdan torpedo, it is not in a condition to be remarked about. There is no such thing as a Berdan torpedo. There is a Berdan torpedo on paper which is supposed to be a rocket torpedo. I believe the idea is that it is to go at double the speed of the Whitehead, to steer doubly as well, to dive under nets, and to come up above nets, and all this with rocket composition for its motor, and to be steered by two wires. I am afraid I have not been able to answer the questions very fully, but I have to thank you and Admiral Boys for your kind attention.

The CHAIRMAN: I am sure we shall all join in a vote of thanks to the lecturer for his very interesting paper.

Friday, January 26, 1883.

LIEUT.-GENERAL SIR C. P. BEAUCHAMP WALKER, K.C.B.,
&c., &c., in the Chair.

CYPRUS AS A STRATEGICAL POSITION.

By Sir SAMUEL WHITE BAKER, KT., M.A., F.R.S., &c.

(Read by Captain E. Palliser.)

THE Colonial Empire of Great Britain necessitates the command of all maritime highways. The population of thirty-five millions cannot be supplied by the limited area of our soil, and the food for a hungry multitude must depend mainly upon imports from distant countries. Statesmen should reflect upon the condition of England if embroiled in a great war with several maritime Powers as her opponents. Every highway would be menaced: freights and insurance would rise in proportion to the increased risks; and the price of corn would materially influence the political opinions of the British public.

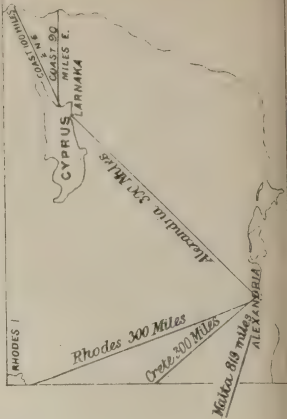
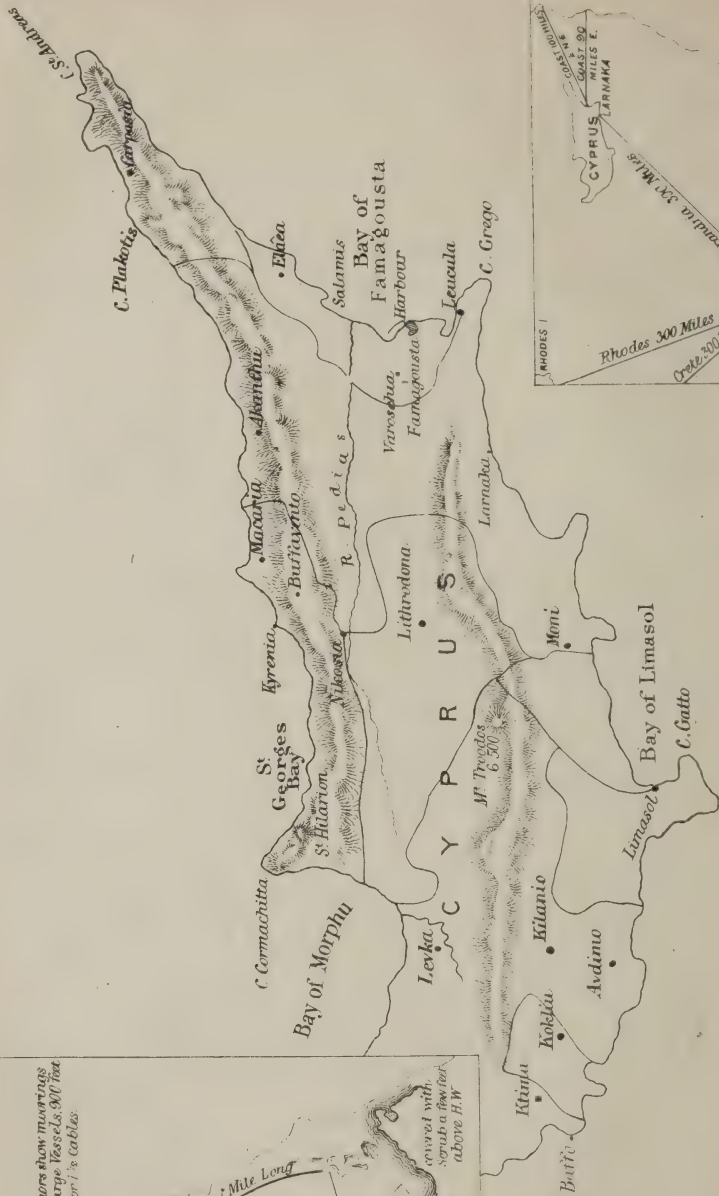
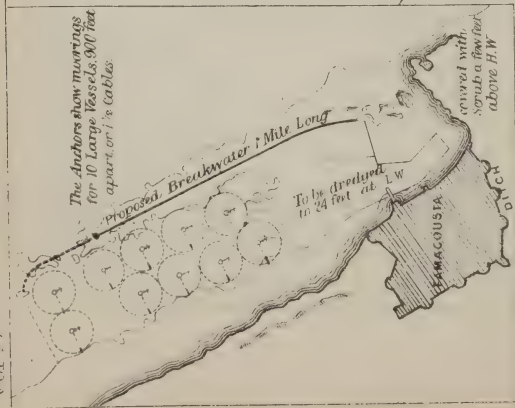
The first duty of a responsible Minister of the Crown is to ensure the safety of his country, and to provide in time of peace for the contingencies of war.

The improvements in naval architecture have entirely altered the conditions of warfare, and the first necessity which dominates the argument is a supply of that great generator of power, "coal," without which the strongest Navy would be impotent.

It is, therefore, incumbent upon our Government to secure certain positions throughout the seas and oceans of the world, which would ensure an unbroken chain of stations that could be relied upon as depôts for a coal supply; and at certain intervals to arrange facilities for the repairs of ironclad vessels, by the establishment of arsenals and dockyards.

The actual power of a country will be exhibited by the number and positions of its coaling stations, all of which must be fortified, as they would become the chief objects of an enemy's attack. It should also be remembered that a victorious naval action would probably necessitate repairs of vessels which could not be completed except within a dockyard, and that the highly complicated construction of our modern vessels renders such dockyards absolutely necessary throughout the principal commercial routes of Great Britain, which will be protected by the vessels of her Navy.

When Lord Beaconsfield astonished the world by the announcement



that Cyprus was to be occupied by England as a *place d'armes*, there were conflicting opinions upon the importance of that island, which resulted in passive neglect, until the military and naval operations in Egypt necessitated its employment. It is a curious fact that at the commencement of the Egyptian disturbance Her Majesty's vessels were ordered to assemble in Suda Bay in Crete, although Cyprus was actually in our occupation and within twenty-four hours of Egypt! Questions upon this subject were asked in the House of Commons, and letters to the "Times" directed the attention of our authorities to the neglect of Cyprus, which was forthwith acknowledged as an important position. Depôts were formed upon the island, and it became useful as a sanatorium, although it had originally been condemned as a pestilential climate.

The attitude which England has recently assumed in Egypt compels us to examine the strategical value of Cyprus, which, by its geographical position, dominates the approach to Alexandria and Port Saïd.

The necessity of coaling-stations demands a chain connected at intervals of five days' steaming. From England to Port Saïd we possess Gibraltar, Malta, and Cyprus; the occupation of the latter completed the hitherto missing link.

Port Saïd, Suez, and Aden will continue the line of stations to the entrance of the Red Sea, and will practically secure our route to India.

An examination of Cyprus as a strategical position will induce a wide consideration of our actual position in Egypt. It may be argued by those opponents of the Cyprian occupation that the possession of Port Saïd and Alexandria would neutralize the value of Cyprus as a British possession, and that we should cling to an occupation of those important points in preference to a costly maintenance of a neglected island.

On the other hand, we must consider the various aspects without prejudice, and ask ourselves these questions: "If Egypt were independent of British control, could we afford to see France in the occupation of Cyprus?"

"If England were in permanent occupation of Egypt, could we permit a rival Power to establish a force in Cyprus?"

"If England were established both in Cyprus and in Egypt, would not the possession of the former guarantee the safety of the latter?"

"Would any Power venture to attack Egypt while Cyprus was a military and naval station, within a long day's steaming of Alexandria and a short day from Port Saïd?"

It appears to me that the island of Cyprus possesses immense geographical advantages; at the same time I admit certain drawbacks which it will be necessary to consider.

If we acknowledge the necessity of a coaling-station to complete the links from Gibraltar towards the East (supposing that Egypt is independent of Great Britain) there can be no doubt of the great importance of Cyprus, as our vessels would emerge from the port with full power to operate against an enemy's fleet in the Eastern Mediter-

anean, or to blockade the coasts of Syria, only nine hours distant. Thus, as a coaling-station, the position would possess great geographical advantages, as Cyprus would form a centre with short radii to most important points, including Beyrout, Alexandretta, Smyrna, and the entrance of the Dardanelles, in addition to its acknowledged superiority as the sentinel of Egypt.

In regarding the military operations of a general European disturbance, the island of Crete would form an important strategical position in the hands of an enemy, if Cyprus were a portion of the Ottoman Empire as heretofore; but should Famagousta become a port and an arsenal in the hands of England, Crete would be paralyzed, as the occupant would be hemmed in upon west and east by Malta and Cyprus. When we consider the great varieties of ammunition, and its extreme weight as employed by modern naval artillery, it is highly important that stores should be supplied to every depôt, from which our vessels could draw in case of necessity. Thus Cyprus would form a convenient base for all operations in the Eastern portion of the Mediterranean, where our naval forces would be concentrated for the protection of the route to India.

If we agree in allotting to Cyprus the geographical position that is necessary as a valuable strategical point, we must examine the salient features of the island before we can determine upon the actual strength of the situation.

It is useless to refer to past history in order to prove the present importance of Cyprus; the conditions of warfare have entirely changed, and the relations of ancient wars have no affinity to those of modern times. We merely accept the position as one of strategical value, but at the same time we must demonstrate both the strong and the feeble features of the island as a *place d'armes*, for which it was specially occupied.

If England is to retain possession of the route to India, *she must be all-powerful at sea*, and her chain of stations will be merely harbours and depôts for her naval and military power; but in the absence of naval superiority, the line of fortified positions would simply represent a passive element of strength. These might be masked or blockaded by a superior naval force, and consequently rendered useless; the chain of stations will be of importance so long as our maritime power is in the ascendant. Should our fleet be absent from the coasts of Cyprus, an enemy could land without impediment upon various portions of the shores, and the chief arsenal or depôt must be prepared to resist an attack by land at the same time that it would be invested by sea; precisely under the same conditions that Famagousta was defended by the Venetians against the Turks.

In regarding the coast-line of Cyprus we must accept the difficulty of defending an island of 145 miles in length by about 50 in width, excepting the narrow extremity towards the east. Unless a large military force were stationed in the island it would be impossible to prevent a landing.

There are numerous little cays in secluded positions around the coasts which offer every facility for the disembarkation of troops. On

the south-east, between Famagousta and Cape St. Andrea, the line is indented with innumerable sandy coves, which at present shelter the small coasting vessels in adverse weather.

The northern coast-line is more rugged, but nevertheless there would be no difficulty in landing upon various points, especially to the west of Kyrenia, where many small bays are formed by projecting promontories, and a sandy beach affords an easy approach.

Kyrenia was an ancient harbour of some importance, and the outer walls of the fort are in solid condition, but the port is too contracted for the entrance of modern vessels of war, and could only be used for the small trading ships which represent the local mercantile marine. Although the walls are of solid masonry, and about 70 feet above the bottom of the broad fosse, they would not sustain a regular attack by heavy metal. On the other hand, the position is important, as the fort not only commands the small harbour, but is the key of the approach to Nikosia by the north, which is only 17 miles distant.

The Carpas range of mountains rises like a wall to an elevation of about 3,000 feet parallel with the sea, from which the base is hardly 3 miles distant in the widest part, and is only 1 mile in width from the fortress of Kyrenia. It is exactly opposite this fort that the straight road ascends gradually to the foot of the difficult pass by which the mountain route leads to the capital, Nikosia. About 4 miles along the sea margin towards the west, the mountains ascend abruptly within a few hundred paces of the shore.

The difficulties of an invasion of Cyprus from the north would be extreme, owing to the natural impediment caused by the abrupt walls of the Carpas range of mountains. Although a landing might be easily effected, a comparatively small force might defend the passes against greatly superior numbers until the arrival of a relieving squadron would imprison the invaders between the sea and the extremely narrow base of the Carpas Mountains. Strong north-easterly gales render the approach to this coast dangerous, and no General would select any point upon the northern shores of Cyprus as a place of disembarkation.

The Bay of Morphu affords an uncertain refuge, but although the sandy coast appears to invite a landing, the surf breaks in shoal water at a considerable distance from the beach, which would endanger boats except in calm weather, and the anchorage is unsafe owing to the sandy and loose nature of the bottom.

On the whole northern shore there is no special point to invite attack except Kyrenia, where the old Venetian fortress still exists. As this commands the harbour, and also the approach to the pass over the Carpas range to Nikosia, it would be advisable to construct a few detached forts connecting the foot of the pass with the fort, which is little over a mile in distance. Such a line of defence would completely intersect the narrow base at a right angle with the sea and the perpendicular face of the mountain range between the castled crags of St. Hilarion and Buffavento. The natural facilities of the locality would render the construction of such a line of works an affair of a few weeks, which could be commenced only upon the approach of war.

The south coast of Cyprus is seldom exposed to storms, and although the only real harbour is confined to Famagousta, there are perfectly safe roadsteads with firm holding-ground in the Bays of Limasol and Larnaca. The former of these has always been selected as the place of disembarkation for an invading force, and it is difficult to conceive why it was neglected, and the preference accorded to Larnaca at the commencement of the British occupation in 1878. Limasol is a charming neighbourhood, abounding in evergreen caroub trees, which afford a shade within a few yards of the sea-margin. These sheltering trees may be counted by the hundred thousand, and would have given a cool welcome to the over-heated troops that were landed at Larnaca during a July sunshine, to sicken and fill the hospitals through exposure in a treeless wilderness. It is hard to imagine the reason which induced our authorities to select Larnaca as a landing-place. For a radius of 25 miles the country is an apparently barren waste of chalky surface, glistening with white marls and crystals of sulphate of lime; admirable ground for cereals, but burning hot during the summer months, and absolutely devoid of shade.

There could not be a worse station for troops than Larnaca, and the only reason that can be adduced for the fatal error of its selection was the comparative proximity of the inland capital, Nikosia, 28 miles distant.

It is well known that our troops sickened with malarious fever, and that the entire force would have been incapacitated from active service, had it become necessary, as was then anticipated. This distressing state of affairs stamped Cyprus as an unhealthy station, and the fact was seized upon by the political opponents of Lord Beaconsfield, and grievously exaggerated. It cannot be denied that an unprecedented rainfall during the winter and spring had saturated the soil, which, in the total absence of artificial drainage, had caused pestilential emanations.

At the same time that unusually adverse climatic conditions existed, the troops were disembarked upon a miserable coast without the necessary accommodation, and were overworked in a burning sun, and camped upon the margin of a reeking swamp at Larnaca. If the force had been landed at Limasol, each man would have had the advantage of a shady tree, beneath which the bell-tents would have been comparatively cool; at the same time the moral effect of a verdant country would have avoided the despondency created by a scene of scorching barrenness, such as was presented in the neighbourhood of Larnaca.

Limasol must become the chief port of Cyprus. It is the centre of the wine-producing districts, and the direct route towards the mountain sanatorium upon the Troödos range. A military road has been constructed to Plätraes, 30 miles distant, and the highest camp upon Mount Troödos is nearly 6,000 feet above the level of the sea, 35 miles from Limasol. The various elevations of Cyprus afford a continual graduation of temperature. The western and central portions of the island are peculiarly characterized by a series of plateaux at in-

creasing altitudes, which form natural terraces, and consequently vary in climatic phenomena.

It is hardly necessary that the sanatorium should be placed at 5,800 feet, as I proved by experience that an elevation of 4,500 ensures a most perfect temperature; but during the exceptional sickness of the troops in 1878 it was natural that the highest attainable elevation should have been selected.

Limasol being the important port in direct communication with the sanatorium, must be accepted as the future commercial centre, and as such it is at present entirely unprotected. There can be no doubt that if Cyprus is to become a British possession, both the ports of Limasol and of Larnaca must be protected by earthworks mounting heavy guns, that would prevent the sudden entrance of an enemy; otherwise the shipping and the towns themselves would remain at the mercy of the first attack. Even the small harbour of Baffo (Paphos) was considered to be worthy of protection, and should our Government decide upon the retention of Cyprus, the British flag which denotes the entrance to Baffo should either be hauled down, or supported by defensive batteries.

It will be clearly admitted by all parties that the present position of Cyprus is unsatisfactory, and it is impossible that the island can remain in a state of ruinous uncertainty—as a strategical point. If it is to become valuable, it must be fortified; in its present state it is utterly unprotected, as there is literally not one single gun in position! This after five years' occupation!

In my own opinion (and I believe I am supported by that of Lord Wolseley, who was High Commissioner in 1879) Cyprus would become an invaluable possession if *actually British*.

There are few places that combine an agricultural and commercial value together with an important strategical position; Cyprus possesses this combination.

Malta and Gibraltar are simply fortresses, which, in the event of siege, must depend upon their supplies that have been stored within their magazines. Cyprus is a productive country, not only self-supporting, but exporting wines and cereals; thus Cyprus could support an army independently of assistance from without. This is an important element of strength.

At the same time it may reasonably be argued that the extensive area which enables Cyprus to produce so largely is in itself a source of weakness, as the long coast-line must be defended.

To a certain extent this is correct, but on the other hand, if we accept the geographical conditions of Cyprus, coupled with the actual naval and military position of Great Britain, the defence of the coast-line dwindles into insignificance. The question is really this: "Would an enemy venture to land a force upon Cyprus, unless the maritime superiority of England was completely effaced?"

We will admit that owing to some necessity Cyprus may have been left unguarded, and that an adventurous enemy disembarks 10,000 men upon the coast. If the chief points, such as Famagousta, Larnaca, and Limasol, are fortified, the enemy's force must become prisoners

upon the arrival of the English fleet. They may have produced some temporary mischief, but the end must be certain; they must lay down their arms, as there would be no escape, and England could pour into the island any number of troops to overwhelm the invader.

As I before suggested, the value of Cyprus as a strategical position depends entirely upon our superiority at sea. There are numerous islands in the Eastern Mediterranean of great geographical importance, but they would be simply prisons to any occupant should the enemy have the command at sea. Cyprus would be the same; precisely as Crete and other islands would be at the mercy of England should a war arise with Turkey. If Cyprus had remained in the hands of Turkey, it must have abided the action of England in the event of war. If we look back to history we find that, in spite of the heroic resistance of the Venetians, Famagousta was at length forced to capitulate through famine, owing to the superiority of the Turks at sea. The rule will apply to every island; even to our own home, Great Britain.

Under these circumstances the invasion of Cyprus by an enemy is not to be expected; therefore the difficulty of protecting an extensive coast-line is reduced to a minimum. The necessary defences would be limited to the entrance of the two ports—Larnaca and Limasol—and to the two small harbours—Baffo and Kyrenia.

The engineer would devote his attention to the key of the position, Famagousta.

When considering the importance of Cyprus as a strategical position, we must at once face the existing difficulty of the "Convention." The island should belong absolutely to England. I will not venture upon diplomatic arrangements, as they are beside the present question, but I will simply appeal to common sense, which would refuse to sanction a large expenditure upon a position that forms a portion of the Ottoman Empire.

Before all questions Cyprus must be accepted as a part of the British dominions. Regarded in this light, the situation at once is changed. Capital would flow from the mother country. The value of land would be trebled in the first twelve months. The resources of the island would be rapidly developed, and Cyprus would in a few years represent the most flourishing colony of the British Empire. It would become the gem of the Mediterranean. This transformation from neglect and perplexity would be the immediate result of the confidence that would be established by the British acquisition.

Under these conditions there would be no dissentient voice, and Famagousta would become a stronghold of the first importance.

The main feature of this position consists in the reef of rocks which forms a natural sea-wall parallel with the shore, for a length of about a mile.

Although the neighbourhood of Famagousta is an undulating and almost treeless plain, every foot of which is more or less under cultivation, the surface soil is seldom above 2 feet in depth upon the higher land in the vicinity of the fortress. The substratum is sedimentary limestone, which would prevent an enemy from approaching by the ordinary

means of sapping, as it would be impossible to cut sufficiently deep for trenches. The Turks experienced this difficulty in 1571. The following notes were made upon the spot in 1879, and although the measurements are not absolutely exact, they are sufficiently correct to convey an idea of the position :—

“ The walls of Famagousta are imposing; they are constructed of carefully squared stone, joined with cement of such extreme hardness that the weather has had no destructive effect. The perimeter of the fortress is about 4,000 yards; the shape is nearly a parallelogram. The fosse varies in depth and width, but the minimum of the former is 25 feet, and of the width, 80 feet, but in some places it exceeds 140 feet. This formidable ditch is cut out of the solid rock, which is the usual calcareous sedimentary limestone; the stone thus obtained has been used in the construction of the walls. The rock foundation would render all mining operations extremely difficult. The fire from the ramparts is increased by cavaliers of great size and strength, capable of mounting numerous heavy guns at a superior altitude. The only entrance from the land side is from the south-west corner; this is exceedingly striking, as the fosse is about 140 feet wide, the scarp and counterscarp almost perpendicular, being cut from the solid rock. A narrow stone bridge, upon arches spans this peculiar ditch, the communication depending upon a double drawbridge and portcullis.

“ The parapets in the angles of the embrasures are 25 feet in thickness; and time appeared to be almost harmless in attacks against these piles of solid masonry.

“ The water supply depends upon an aqueduct of several miles in length, as that produced by the wells within the walls is brackish. The aqueduct runs along a line of sandy heights before it enters the fort. The highest point of this position is about 600 yards from the gate of Famagousta. I counted the embrasures of six guns that could have been brought to bear exactly upon my tent 200 yards from the windmill of Varoschia. At the same time I remarked that we commanded the lower portion of the fortress, and could fire into the rear of the batteries upon the sea-wall within the water-gate, thus sweeping the guns in reverse at a most destructive range.

“ The water-gate from the harbour is approached by a winding entrance beneath a powerful circular bastion from an extremely narrow quay, from which the remains of a once formidable mole projected about 120 yards into the sea, and commanded the inner harbour. A citadel that is separated from the main fortress by a wet ditch which communicates with the sea by an adit beneath the wall, commands the harbour upon the east side. This ditch is as usual scarped from the rock.

“ There are three points adjacent to the fortress that demand the erection of detached forts. Although open to the east and south-east, Famagousta is the only real harbour in Cyprus available for large vessels, and there can be no doubt that a moderate outlay would make the additions requisite for a first-rate and impregnable arsenal and coaling-station.

"It was blowing a fresh gale from the south-east when I was upon the ramparts facing the sea above the water-gate, and an admirable example was displayed of the wave-breaking power of the long line of sunken reefs, which forms a continuation of those natural breakwaters above the surface that have created the harbour. A heavy surf exhibited a creamy streak along the margin of comparatively still water within the reefs for about a mile, parallel with the shore, comprising an area of about 700 yards width at the extremity of the sunken rocks, and 500 from the existing breakwater, exactly opposite the water-gate.

"The picture presented during the strong gale was thoroughly illustrative of the natural advantages and the future requirements of the harbour.

"The long line of reefs which form the outer protection, would, were they exposed in their whole length, represent an irregular incline from 12 feet above the sea-level at the southern end, to 3 fathoms *below* the surface at the northern extremity. A wedge laid with its broad base to the south would represent the inclination of this long line of useful reef, which can be converted into a sea-wall by simply filling-in with blocks of concrete to a sufficient height above the extreme water-mark. The ancient jetty which connects the small islands that form the northern head of the reef, is in itself an example of the necessity of such an extension throughout the line. A natural headland terminating in disconnected rocks upon the north boundary of the reef about half a mile above the fortress, is a secure protection from the sea, but it admits the silt. This has completely filled-in a considerable portion of the original harbour; were this sea-communication prevented by connecting the various reefs with the main headland, the evil would be at once removed, and the inclosed area might be cleansed by dredging.

"There are two enemies to be resisted,—the sea, and the silt. The latter has been and still is brought down by the Pedias River; this has entirely blocked the ancient harbour of Salamis, and partially destroyed that of Famagousta. The engineer has to repel these enemies, but he possesses a great advantage in the fact that Famagousta has already existed as a most important harbour, therefore he is not experimenting upon an unknown bottom. The line of reefs affords the engineer's chief desideratum, "a sound foundation;" and the materials for his concrete blocks are close at hand in the native rock from which Famagousta has been quarried, and in the island of Santorin from whence the *pozzolano* is supplied for hydraulic cement, only three days distant. Few places possess in so high a degree the natural advantages for becoming a first-class harbour, and it has been computed that about 300 acres of water can be converted into a wall-locked basin, with an entrance from the south that would be secure during all weathers.

"The fact should be remembered that Admiral Sir Geoffrey Hornby took the Mediterranean Fleet into the harbour of Famagousta in 1879, and anchored without difficulty."

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The foregoing opinions upon Cyprus and especially upon Famagousta must be accepted as non-professional, and simply as emanations from a common-sense observation of the island. It may be argued that Famagousta as a harbour could not protect a fleet, as it would remain exposed to the enemy's fire from seaward. On the other hand, the line of reefs would be steel-faced casemated batteries, *à fleur d'eau*, mounting 80-ton guns, while the ships within the harbour could fire above these batteries, and would be supported by the heavy metal of the fortress that would over-top the fire of the ships and reef defences. By land the investment of Famagousta would be almost impossible, as it is protected by the marsh of the Pedias River upon one side, and the detached forts would render an approach upon the remaining two sides extremely dangerous, while the difficulty of sapping through a rock substratum has already been explained.

In balancing the position, we must discard all party and political prejudices, and simply regard the island in its geographical position. If Cyprus were in the hands of an enemy, our commercial route to India would be imperilled, and our hold upon Egypt would be insecure. If in the hands of England, it may become the key of the position, and as a strategical point will dominate the eastern portion of the Mediterranean, and command the approach to Egypt, and the entire coasts of Syria.

In its present equivocal position it is useless except as a sanatorium. It necessitates the gravest attention of the British Government. If it is to become a permanent possession of Great Britain, we should at once decide upon the terms of acquisition. If it is to remain a vexed question under the terms of the original Convention, it will be absolutely valueless for the purpose which induced the occupation, "as a strategical point of vantage, and a *place d'armes*."

The CHAIRMAN: We shall be very happy to hear any remarks from any gentlemen present that will throw any light on the question of Cyprus, or afford some further information; if there is any gentleman present who has recently visited the island, perhaps he will be good enough to help us by starting the discussion.

Mr. WISELY, R.E.: Having been in the island of Cyprus the last four and a-half years, I should like to make an observation or two on what we have just heard. (1) With regard to choosing Larnaca rather than Limasol as a place for camping troops, I should think the principal reason was, that at the time of the occupation there was at Larnaca a good water supply. The Officers who went there were doubtless influenced in their choice by that consideration. At Limasol, which Sir Samuel Baker recommends in preference, there was at that time no good drinking water at all, except a limited supply brought in on donkeys from a distance of 4 or 5 miles, and even now there would be difficulty in providing water for a large body of troops. (2) Then the trade of Larnaca is certainly four times as much as that of Limasol, and the latter shows no signs as yet of taking the lead as a commercial port. It is shut out by the mountains and by distance from the rich corn-growing country in the centre of the island. (3) Then as to the question of fortifying Limasol or Larnaca, those who have been there will recollect that there is no regular harbour, no line of reefs on which forts could be built, and no facilities for making fortifications. They are roadsteads, open to the sea, and it would be extremely difficult to form any fortifications there to defend the anchorages. (4) The heights of Troödos, where the troops camp every summer, is

almost the only convenient place for placing a large body of men. Lower down, where Sir Samuel Baker was, there is room for about two battalions, but certainly not for more than that; on the higher levels there is room for 10,000 men, and the water sources are available for their use on three or four sides. (5) Then about Famagousta: in considering the question of fortifying Famagousta, the water supply has to be particularly attended to. It comes from beyond Varoschia along the coast, and would require to be well guarded. The position of Famagousta is upon a line of elevated ground, which terminates about 3 miles north, and runs about 3 miles south, where it joins the heights which bound the Messaria on the south. It is a rather narrow plateau, about a quarter of a mile wide, along the sea coast; then going inland from Famagousta one crosses a succession of two or three valleys, and lines of heights running approximately north and south, and then at about 2 or 3 miles distant there stretches away the plain of the Messaria. It would be rather difficult to defend a camp on the land side without throwing forts out on the heights beyond. (6) The idea as to Cyprus has been that it would be of advantage to England as a secure base of operations for carrying on a war in the corner of Asia Minor, Syria, or in Egypt, and at the time of the late war in Egypt, I believe we had orders to prepare for a very large body of men, which shows that Lord Wolseley's intention was to have made use of Cyprus as a base against Egypt. But it occurred to me, and no doubt it must have occurred to every one at the time, how very much more useful Cyprus would have been if we had had large magazines there, and a sheltered harbour and everything to make it of use as a base. Fortunately for us, we had not those troops thrown upon the island. It would have been very difficult to provide for their wants; but no doubt if a large sum of money was spent in fortifying and improving the harbour of Famagousta, making good magazines, and preparing for contingencies by keeping up great stores of material, then I think Cyprus would be of use to us as a military station—not only when a war is actually being undertaken in the neighbouring lands, but also before war is declared, and at the critical time. It will enable us to make there a strong military demonstration, by which very show of force, war may happily be averted.

Major CLAYTON, R.A.: I should like to refer to two points. In the first place, as regards the value of Cyprus during the recent campaign, I was in command of the dépôt of artillery which was intended to be sent to Cyprus on that occasion. The history of what took place was this, that a certain part of my dépôt started in the beginning of September for Cyprus, and arrived there in due course; but before the headquarters of the dépôt with myself were able to start, which we did on the day after the battle of Tel-el-Kebir, the orders came for us to go straight to Ismailia, and not to Cyprus at all: that is to say, the establishment of a dépôt of artillery at Cyprus really broke down before it was absolutely carried out to its completion. Although the result of the splendid victory at Tel-el-Kebir rendered it unnecessary for any dépôts to be formed at all, yet I think what happened proves tolerably well that the place for a dépôt for operations in a foreign country is at the base of operations in the country itself, and not at a distance separated from that base by a considerable space of sea over which troops cannot be got in a hurry, without the delay and trouble of sending ships from the base to the dépôt, embarking the troops, and bringing them back. The place for a dépôt is nearer the base than a point separated by several hundred miles of sea. The second point is as regards the effect produced by the occupation of Cyprus by the English. In 1879 I was sent into the interior of Asia Minor to act as Consul, and remained there more than two years, and many a time have official Turks and others come to me and said, "What is it England wishes to do in Asia Minor?" My answer was, that we desired to have reforms carried out in order that the Turkish Empire might be strengthened and no excuse afforded to foreign Powers to interfere with its government. The reply always was, "Well, if that is the case, *why did you take Cyprus?* If your only object was the strengthening and the integrity of the Turkish Empire, why did you take Cyprus?" The idea among the Turks evidently was, that England was desirous of territorial acquisition, and nothing that I could say could remove this impression. Therefore, what I ask you to consider is, whether the strategical advantages, which no doubt exist to a certain extent in Cyprus, are worth the loss

of influence which I am certain England has experienced in the councils of the Turkish Empire on account of her having taken possession of that island.

Captain J. C. R. COLOMB, R.M.A.: I should like to say a word, on the general question of Cyprus, as to its imperial strategical importance. I very greatly regret that Sir Samuel Baker is not here, because I am compelled to differ with his very opening sentence. He says, "The Colonial Empire of Great Britain necessitates the command of all maritime highways." I do not think the Colonial Empire creates the necessity, for I think the necessary command of the imperial highways necessitates the maintenance of our Colonial Empire. Our maritime supremacy rests upon the naval facilities our colonies afford to our fleets. Then, again, Sir Samuel Baker says that in a great war "with several maritime Powers" our highways would be menaced. I think he might have left out the "several" and have put in "one or two." "It is therefore," he continues, "incumbent upon our Government to secure certain positions throughout the seas and oceans of the world." I think we are all agreed upon that. I think the former Government was agreed upon that, because three-and-a-half years ago they appointed a Royal Commission, which has been sitting ever since, to point out what those positions are, and how they are to be defended. There is another question I was very anxious to ask Sir Samuel Baker, and that is, why he fixes the arbitrary limit of five days as the steaming distance between coaling-stations? I attribute no importance to the limit of time; I think the distance of your coaling-stations cannot be regulated in that arbitrary manner. The capacity of the bunkers of your ships and other circumstances will rule that question. Now I narrow down to the point of Cyprus particularly. Sir Samuel Baker asks this question: "If England were established both in Cyprus and in Egypt, would not the possession of the former guarantee the safety of the latter?" Well, I think that question may fairly be reversed in this way, "If England were established both in Cyprus and in Egypt, would not the possession of the latter guarantee the safety of the former?" I think the present political position of Cyprus is to be condemned: it is neither one thing nor the other. Supposing it becomes a British Colony, the question is whether, as an imperial position, it is worth the expenditure of a very considerable sum of money for its strengthening as a naval base. Now I object to that question being entirely treated with reference to one imperial road only. We must cut our garment according to our cloth, and the difficulty of arranging for the true defence of our Empire is the difficulty of money. Therefore, before anybody can rightly decide whether to expend a large sum of money for the purpose of creating a naval position considerably off any direct line and as a result to divide our forces,—because I maintain that Cyprus is useless as a protection to the Canal, for it is at the Canal we must defend it,—I say before you can decide whether, as an imperial question, the value of Cyprus is such as to warrant a large expenditure of money, you must look all round the Empire; you must be clear that it is *the one position* out of very many which requires the expenditure of that money most; and I do think, with Malta and Gibraltar, and the necessary precautions for securing the Canal at the Canal, that fact cannot be established. It would be rather tending to weakness than to strength to expend resources—sorely needed at positions commanding other lines of communication—on Cyprus. If we take the relative value of the equatorial crossing of the Atlantic, it is roughly 110,000,000*l.* a year, in round numbers, in value of British goods. Four years ago I estimated the value of British goods passing through the Canal at 82,000,000*l.* a year; the Government, I am happy to say, have since made an inquiry of the various Chambers of Commerce in the United Kingdom, and after great difficulty have ascertained that 92,000,000*l.*¹ of British goods pass annually by and through the Canal. So in value of British goods the equatorial Atlantic is more important than the Canal. Taking that ground alone the equatorial crossing, and the British ports in the vicinity, demand defence. There is not one position there, not a single coal depôt, with modern guns or adequate means of defence. Therefore,

¹ The difference between my estimate for the year 1878 and the Chamber of Commerce calculation for 1882 is fairly accounted for by the increase of traffic through the Canal in 1882 over that of 1878.—J. C. R. C. (*vide* "Naval Intelligence," &c.).

extra incumbrance, and requires two horses and two drivers, thus adding twelve drivers to the complement of the battery. On the other hand, it will save the ambulance corps and reduce the number of wounded men; it will preserve the efficiency of the battery by protecting both men and horses; and it will add a moral force to the gunners by the security afforded, which will ensure calm and steady firing.

Carts upon this principle would be invaluable in many circumstances, and there is no reason why they should not be used under a variety of conditions. In savage warfare, such as that in Zululand, they could be drawn up in a square at night, and when tilted, they would form an impenetrable wall of steel. Such a fort, which could be improvised in a few minutes, would be impregnable to an enemy unprovided with artillery, as riflemen would fire through the apertures specially arranged for that purpose. The system might be extended for the protection of infantry, as there is no limit to the modifications which might be made upon such much-needed constructions for a protection from the fire of long-range rifles.

It may be contended against this principle that the combination of shield and cart would encounter difficulties in practice; the cart would be overloaded, and thereby rendered inoperative. The temptation of a cart can never be resisted by the men, and all kinds of impedimenta would assuredly be added to the recognized load.

There is no absolute necessity for the combination. The shield would be even more practical should the sides be only 4 inches deep, so as to afford a simple impervious screen to the gun when the flap doors should be thrown open.

Captain R. F. JOHNSON, R.A.: Although half-an-inch of steel may be a very pleasant thing to get behind in action, I am afraid there are several points in the proposed shield which make it objectionable to artillerymen. In the first place, shields, if of use at all, would probably be of the greatest use at close quarters. If the guns have to retire in such circumstances, separate (*i.e.*, not attached to the gun carriage) shields would have to be abandoned. Again, aimed fire at long ranges is not so much to be feared as previous exertions, excitement, and smoke, which must spoil the very best shooting. The Transvaal War has often been brought forward as an example where the shield would have been useful; but the Boers were altogether an exceptional enemy, trained to shoot by habits of the chase. The protection against unaimed, or rather badly aimed long distance fire is not so great as would appear at first sight: for all the detachment, when they are working a gun, must be at least 5 feet from the shield except two of them, who would get inside the wheels (the wheels of a gun are 5 feet in diameter). Even at 1,500 yards' range a Gras bullet, just missing the top of the 6 ft. 6 in. shield, would hit a 5 ft. 8 in. man, 4 feet 6 inches behind it; while at 3,000 yards range, a Martini-Henry bullet would hit a man 2 feet behind the shield. Again, at a distance of 1,500 yards from the gun, a man 750 yards to one side of the perpendicular would be able to see the back of the wheels past the edge of a 10 ft. shield, and his range would be less than 1,700 yards. From this it follows that the protection of such a shield to the limbers and teams, 10 yards in rear of the gun, would be almost, if not absolutely *nil*; and this is a most important point, because it is the loss of horses and not of men that cripples field artillery in a long series of engagements. Perhaps the most serious objection of all is the increased size of the target that would be presented to the enemy to fire at; and it must be borne in mind that the pretty Aldershot practice of concealing the guns on the reverse slopes of a hill would not be possible in action on account of the recoil, and the labour entailed in

running up. The cart may certainly be tilted in two seconds, but it would be pretty smart work to get the horses unharnessed and unhooked and clear in one-and-a-half minutes; and during all this time the enemy would have raised in front of them, in every battery, a nice row of six targets, each 10 feet by 6 feet. The thickness of the proposed shields would be just sufficient to burst a common shell with a percussion fuze, but not to stop it; and if Lieutenant Hickman, at Kassassin, had had a couple of shield screens in front of his guns for the Egyptians to burst their percussion fuzes on he would probably not have been able to stop there like he did. The shields are 13 cwt., but with the heavily-tired wheels, steel shafts, and various other parts of the carriage, the total weight would not be very much less than 18 cwt., or 3 cwt. per horse too much for horse artillery. Again, whenever the men had to run up the gun after it was discharged they would be greatly exposed. The Russian artillerymen in the Shipka Pass found that they suffered most when they had to run up the guns to the parapets. A shield on the gun would run back with the gun; the men would always be closer to it, and the target presented by the gun need not be so very much increased in size; besides which the limber box might be armoured so that when lifted it would give considerable protection to the team if the back of the boxes was towards the gun. The great objection to shields on the gun limber is the extra weight. It is said the present weight carried is the greatest that is allowable, but the twelve horses necessary for this proposed cart would be able to pull, in two ammunition wagons—six horses apiece—2,400 lbs. weight of ammunition, which would allow the limbers to be considerably lightened, and also increase the total number of rounds carried by the battery, and with an improved construction of carriage might give 300 lbs. to a gun for a shield on the limber and on the gun carriage, and this, with judicious distribution, would probably be found quite sufficient: for half-an-inch of steel is more than is required to stop a bullet, even at close quarters. Supposing an extra amount of transport should be allowed to each battery of artillery—which is not at all likely for many reasons—then there are many other rival claims to be considered at the same time as those of shields: extra ammunition, extra spare horses, machine-guns to protect the flanks and meet infantry and cavalry at close quarters, and others. That the claim of shields does not necessarily outweigh all these others, is proved by the fact that artillery, in a way most perplexing to theorists, and most annoying to infantry, has in all recent wars more than once stood its ground at close quarters without overpowering loss.

The CHAIRMAN: Have you seen a shield in this country?

Captain JOHNSON: The Hotchkiss machine-gun is fitted with one. It weighs 150 lbs.

Captain BURGESS: Has it been introduced into any Service?

Captain JOHNSON: No.

The CHAIRMAN: Did not Colonel Brackenbury propose it at one time?

Captain JOHNSON: His proposal was, I believe, to carry shields in a wagon and put them down on the ground, so that many of the same objections hold good. I do not for a moment wish to deny that shields would be of great use to field artillery, but to point out that they must be permanently attached to the gun and limber. With regard to the high percentage of ricochet hits mentioned by Colonel Hale, it may be remarked that the experiments referred to were carried out on hard level sands peculiarly favourable to ricochet.

Major WALTER UNDERWOOD: About four years ago a Russian iron merchant informed me that he had a contract with the Russian Government to make, for experiment, some chain armour mantelets for embrasures. I am sorry to say I forget what weight he told me they were per square yard, but it was very small. They were to be hooked loosely on frames, so as to increase the resistance to the bullet by yielding on impact. It just struck me that shields might be so made of a very light description which would be bullet-proof at short ranges, and if they did the same work (being carried on the gun) as the heavy cart in the model now before us, they would obviate the objection to which Captain Johnson has referred, viz., requiring extra horse-power. At the Siege of Phalsbourg, in 1814, the French used " wagons blindés " in bringing in their rations under escort, to protect themselves from the fire of the German cavalry, and they are also mentioned in Ducrot's

"Defence of Paris" as being used for a similar purpose during the siege. Another remarkable fact is mentioned by Ducrot, viz., that the only successful attack by the French on the Prussian position at Le Bourget was made by means of *sap rollers*, or hollow cylinders filled with earth, the men lying beneath them and pushing them on. When I read this it appeared to me that some sort of lightly armed wheeled machine should be devised for infantry, who could thus advance rapidly to the attack, or, in other words, form a moving shelter trench.

General Lord CHELMSFORD: I should like to say a few words with reference to the proposal to use chain armour mantelets. I have no doubt that Sir Beauchamp Walker, and others in the room who were in the Crimea, remember the mantelet the Russians had in the Redan, Malakhoff, and other batteries, which was made of very stout rope, and was hung upon the guns exactly in the same way that the last speaker proposes to hang his chain armour mantelet. They must have been effective, because, when I went into those batteries after the siege was over, I did not see one that had been in any way pierced by the heavy fragments of shell or shot which had been fired against them. Some artillery officers here present may perhaps be able to say whether it would not be possible to carry a lighter rope mantelet, of similar description, on each field or horse artillery gun, to be placed over the muzzle of the gun when in action; hanging loose it would give with the impact of the shot, and thus afford protection from rifle bullets, and I believe also from fragments of shell, to the gunners behind it. I mention this as a rope mantelet was a feature in the Russian batteries in the Crimea, which I have never seen elsewhere, and which seemed to answer the purpose very admirably indeed.

Captain COCKBURN, late 42nd Highlanders: I wish to say one word in defence of these shields from the attack made upon them by Captain Johnson. Although it is quite true that the drop of a bullet at these long ranges would hit men very close behind the shield, still the shield would protect them from what is often more dangerous than direct, namely, ricochet shot, by which so many men get hit at long ranges. Years ago I proposed that every gun should carry a light steel shield, to be tilted forward as it was brought into action. They would form a cover for the gun and would be a very useful protection to the artillerymen, for I cannot see how they can possibly live with infantry, properly used in open order, converging their fire on the guns, without some such protection. I think I once before mentioned how at Lucknow, using rifles on rests, I was enabled to shut up the fire of a whole line of loopholes, at the range of from 100 to 200 yards' distance. It was the first time I discovered what a wonderful weapon the rifle was when properly used; previously to that I had an exceedingly poor opinion of it. I remember once seeing my company miss a whole body of cavalry at 100 yards' distance. The word of command was given in a great hurry, and the bullets went flying all over the plain. Ten companies of the 42nd, advancing in direct *échelon* from the left, wheeled to the right, doubled up the top of the ridge, and fired their volleys at the rebel cavalry on the plain below with much the same result. Now in the 42nd, at that moment, there were two men who won the first and third prizes in the Crimean army for shooting, which shows that it was neither the men nor the weapons that were at fault, but only the manner of misusing them. Altogether I do not think they killed more than five or six men, and as many horses, out of the whole ten volleys fired. Of course the rebels drew their picket pegs and were off after the first volley, and those killed were mostly at longer ranges.

Colonel LONSDALE HALE: With regard to ricochet firing, Colonel Fraser, in his elaborate report on the experiments at Dungeness, where the firing was mainly at long ranges, says that out of over 33,000 hits recorded on the targets, 22 per cent. were ricochets.

The CHAIRMAN: I am sure our thanks are due to Sir Samuel Baker for this interesting paper, and also to Captain Palliser for very kindly reading it. Our thanks are also due to those gentlemen who favour us with observations, which are certainly a most valuable part of our proceedings. I wish there were not such extreme modesty present amongst those who really have information, and who, if they thought quietly for a moment, would find their way to impart it to others. It is the most valuable part of our meetings.

Friday, February 2, 1883.

MAJOR-GENERAL SIR ANDREW CLARKE, K.C.M.G., C.I.E., C.B.,
R.E., Inspector-General of Fortifications and Director of Works, in
the Chair.

THE USE AND APPLICATION OF MARINE FORCES; PAST, PRESENT, AND FUTURE.

By Captain J. C. R. COLOMB, F.S.S., F.R.G.S., Half-Pay Royal
Marine Artillery.

Introductory.

THERE is no fighting force under the Crown less understood than the Marines. Few trouble themselves to know more than that they are useful. Why they exist or why they are useful are not questions which attract attention. Parliament always readily grants whatever is asked for their maintenance, and believes, without inquiry, the country gets full value in return. It is the only service taken, so to speak, on trust.

The marine forces of to-day consist of two corps, of an aggregate strength of 12,400 men. The Royal Marine Artillery represents the numerical equivalent of some sixteen batteries of Royal Artillery, the Royal Marine Light Infantry about ten battalions of the line. The national importance of these forces as a distinct element of the fighting strength of England may be best appreciated by remembering that they exceed by more than one-half the total strength of the British Army which fought at Inkerman. They cannot therefore be thought—as a distinct branch of Her Majesty's Service—too insignificant to be worthy of particular examination from a national point of view. It is precisely from this broad point of view they never are criticized, and, therefore, it may be a useful contribution to the literature of the Royal United Service Institution to offer some remarks bearing on a matter so little understood.

The present policy and practice of this country is to create, at a cost approaching 1,000,000*l.* a-year, a military force equivalent to sixteen batteries of artillery and ten battalions of the line, and hand these scientifically trained military bodies over to the Navy to do with them as it seems fit. It practically excludes the Officers of these highly trained troops from occupying any position of enlarged responsibilities or power outside the very narrow limits of their own peculiar service; it even excludes them from serving on commissions

and committees of inquiry into matters relating to affairs of war, though spending vast sums to make these Officers thoroughly efficient fighting Officers and leaders of men by land and sea. The country does this while the cry is for professional Officers, and the demand is for full value to be given in return for public money spent in the acquirement of professional knowledge. The present use and application of marine forces present a picture of confused anomalies and inconsistencies, but before proceeding to examine them with any detail it is necessary to trace them to their source.

Past.

The marine is a peculiarly English institution, and the prologue to his appearance on the stage of English history was that long constitutional struggle between the Crown and the people respecting the maintenance of armed forces. To keep in the King's pay "any other body of armed men save as a guard for the Royal person was a violation of the law."¹ Men might lawfully be pressed to work as sailors; it appeared no great stretch of prerogative to press men to fight the King's ships "as soldiers." It was illegal to land "press-men" in a foreign country, but soldiers in ships off an enemy's coast "only required a very little persuasion to land." This naval diversion of land forces, in order to evade the law, was the original conception which produced British Marines chiefly intended for offensive operations in foreign countries. During the Commonwealth England triumphed on the sea by the application of military power to naval purposes. Blake, for example, was only fifty-nine years old when he died, he had remained seven years at Oxford after taking his degree, and was over forty years of age before he took to arms. He was bordering on fifty when, as Colonel of Dragoons, with nothing but purely military experience, he was selected to command the fleet, and in nine years of sea service he made for himself fame, and for his country enduring maritime renown. He did this by bringing military experience to bear on naval practice. "He was the first man that infused that proportion of courage into seamen by making them see by experience what mighty things they could do if they were resolved; and taught them to fight in fire as well as upon water."² Blake was not a seaman, but a great sea soldier; in other words, a marine clothed with naval authority, and directing naval force during that transition period of separation between land service and sea service.

Five years after the death of Blake the 3rd Regiment of Foot was called the Admiral's or Maritime Regiment, being specially set apart for sea service.³ Four years later the Foot Guards were appropriated to sea service. As these two events are the germs from which have been developed the marine forces of to-day, it may be as well to

¹ Clode.

² Clarendon.

³ It is sufficient here to acknowledge generally information derived from "The Historical Records of the Royal Marine Forces," by Paul Harris Niccolas. [J. C. R. C.]

review briefly the condition of England and of her war forces at that time.

She was then self-containing and self-supporting a population far below her capabilities of natural producing power, greater only by a few thousand than that of London now. The defence of the sea was chiefly necessary for the safety of her own coasts, to secure supplies of luxuries and power of accumulating wealth. Her revenue was less than that now of the Colony of Queensland, founded only twenty years ago. The annual value of her exports was about half the value of the annual exports from Canada at present. The day of her Empire had, however, just begun to dawn. The East India Company had commenced its struggles for the far East, while English settlers were firmly establishing themselves on the American continent in the West. Her West African Company was flourishing in spite of the pestilential regions of the African forts, and her West Indian possessions were already sources of wealth and power. Her sea commerce was being extended by an odd mixture of lawless marauding and honest enterprise. Honest enterprise sent out its merchant fleets and looked for their return at fixed periods of the year, regulated by the nature of the trade and the geographical position of its foreign source. Thus it was by convoys sea trade was protected. But on the whole the attractions of a seafaring life in those days were freedom from the restraints of law, thus presenting an unlimited field for the exercise of uncontrolled individual enterprise, rapacity, and daring. Service at sea for the King was unpopular by reason of restraints necessarily imposed for public purposes. The Navy had to be manned by forcible impress. The streets were emptied of men, "men being so afraid of the press."¹ Naval administration was a "prodigy of wastefulness, corruption, and indolence; no estimate could be trusted, no contract was performed, no check was enforced."² The professional naval Officers bred to the sea "seemed a strange and savage race." "Their deportment was uncouth, their talk, where it was not made up of nautical phrases, was too commonly made up of oaths and curses."³ But naval commands were chiefly held by court favourites wholly ignorant of all things appertaining to the sea, and not always acquainted with fighting on land. Captains and pursers cheated the King and defrauded the seamen. Discipline there was none; system there was none; and the ablest Admiralty official of the time was probably not far wrong in declaring that as things then were "the seamen of England, in my conscience, would, if they could, go over and serve the King of France or Holland rather than us."⁴ The war ships of the time numbered some 140, having an aggregate of some 60,000 tons, carrying some 5,000 guns, and requiring about 30,000 men to man them, but many were rotten and unfit for service. Besides the Life and Foot Guards, the King's exertions had managed to preserve out of the forces drawn home from Tangier, one regiment of dragoons and five regiments of foot; one of these, "the 3rd," was the Admiral's

¹ Pepys.² Macaulay.³ *Ibid.*⁴ Pepys.

or Maritime Regiment; but the militia was the only military force recognized by law. Now, at this period, war operations on land had well-defined principles, and had been reduced to a system; war operations at sea were left "to every man's own conceit." "I have," says the author of the "Sea Grammar," printed about that time, "seene many bookes of the art of warre by land, and never any for the sea." The necessity for uniformity in discipline, in individual training, and even in dress was then well understood and acted upon in the Army; in the naval service then, and for nearly a hundred years afterwards, all these things were despised. It was not, therefore, unnatural to expect that by thrusting into the chaos of naval confusion a nucleus of fighting force drawn from a more advanced system beneficial results might follow. Perhaps it was thought that a little military leaven might leaven the whole naval lump of corruption and incapacity, but after all it was but a miserable expedient to try at a time when the necessity for separating land service from sea service was sufficiently apparent. While England thus fiddled with her naval forces by creating a maritime regiment, France boldly commenced a radical reform of her naval system. One year after the raising of our original marine force, she instituted the "*Inscription Maritimee*," and next proceeded to educate her naval Officers. She attracted and absorbed the best merchant captains into her war navy, at the same time offered inducements to young gentlemen to embrace the sea as a profession of arms, founded schools for their special instruction, and a system of training for all ranks and classes of her war navy. At one sweep she eliminated the purely land element from her Navy, only permitting one military Officer¹ of particular reputation to retain a naval command. The difference of naval policy 200 years ago between France and England is stamped on their Navies of to-day. About one-seventh of the complement of a British ship-of-war are marines; none serve afloat in the fleets of France.

Our original maritime regiment, with its "yellow coats lined with red, its good firelocks and colours bearing the red cross of St. George and the rays of the sun issuing from each angle," disappeared with the Army of Charles II, of which it was an integral part.

Two new regiments of marines were raised in 1694 during the reign of William III. The House of Commons, fearing this to be an increase of the standing army, voted the supply on a resolution "that they were to be employed in the service of the Navy only." Only one regiment was to be on shore at a time; when on shore the men were to be employed in the dockyards, and to receive 6*d.* a-day extra for dockyard work. None of the Officers were to be sea commanders except the two Colonels. When serving afloat they were to be wholly under the command of naval Officers, but the men were to be paid and accounted for when afloat by their own Officers. This latter arrangement was a check against naval fraud but too common at that time. These regiments were disbanded three years later. It would appear they were raised in the hope of first obtaining men as

¹ Duquesne.

soldiers liable to sea service, and then when afloat of inducing them to become seamen. Captains were ordered to report periodically "the names of such soldiers as shall in any measure be made seamen, and how far each of them is qualified towards being an able seaman."

Shortly after the accession of Queen Anne a number of regiments of marines were raised, and the 30th, 31st, and 32nd Regiments of the Line were formed and served as marines. Independent companies of marines for the defence of West Indian Colonies were created. These forces were all under the charge of the Secretary at War. The idea of obtaining seamen through the marines appears to have been at that particular time abandoned. However, at the Peace of Utrecht, the whole marine service was disbanded. It reappeared as part of the Army in 1739. In 1740 three regiments of marines were raised in America, the Colonels being appointed by the Crown, the Captains by the provinces. In 1747 the marine service was transferred by warrant to the Admiralty, and wholly disappeared once more the following year, on the Treaty of Peace of Aix-la-Chapelle. In 1755 it reappeared again, and from that date to this its history has been continuous.

It is fitting here to point out one or two of the salient features of the use and application of the marines up to the time of their becoming a permanent institution.

The military arm in system and in mode of discipline and training was still far ahead of the Navy. The raw material could sooner be converted into a fighting man under military organization and system than evolved out of the chance conditions of a ship. When the stress of war came it found an ever-expanding fleet without any provision for manning it except force. Hence the Navy had to borrow fighting strength from the military arm. The marines of those days were not considered as a reserve for the Navy. They had no existence during intervals of peace, the force only came into being when war burst upon England, and disappeared again when peace was proclaimed. Its place was always in the front line, wherever fighting was to be done. The force was not scattered as now in small detachments, but was embarked in fleets by regiments. It was only in cases of absolute necessity, that a body of less than fifteen men under the command of an Officer, was permitted to be isolated in any one ship. There were no theories in those days, as now, that highly-trained troops were necessary to the performance of ships' duties of the most common and ordinary description. In peace the Navy did its own work afloat without the aid of marines. There were no ideas prevailing then that soldiers must have years of sea experience in order to be efficient marines in war. The marine force was not used as secondary to naval peace requirements, but directly applied to fulfil the conditions of war on the sea in a broader and more primary sense. The defence of our positions abroad open to sea attack, the seizure of similar positions in the hands of our enemies, these were the immediate objects for the use and application of marines during the first half of the eighteenth century. Gibraltar is one of the chief memorials of

their successful use and application. The national importance of the marine service in those days may be gathered from the fact that the Guards, Officers and men, furnished the nucleus of marine regiments raised in 1739. War on the sea was then, what it will be in the future, a struggle for positions commanding the sea, and troops independent of internal naval conditions were necessary to take and to keep such positions. In those days soldiers were transported in fighting ships, and therefore purely military forces often contributed not a little to what are now regarded only as seamen's triumphs.

But the conditions which made a Blake possible had gone for ever. The military reign on the sea was over. Capacity and knowledge in sea affairs was ousting slowly but surely courtly incompetency from naval commands, and sea service as a proper profession for English gentlemen was becoming the fashion. The Navy had so far advanced towards general ideas of system as to be granted a uniform, and a naval academy had been established, in 1729, for the education of young gentlemen for the sea service. Greenwich Hospital had been founded for necessitous sick and wounded seamen, but no comprehensive measures had been adopted for obtaining and training seamen for war service. Just previous to the formation of the present marine force it was proposed in Parliament "to register a certain number of seamen who for an annual stipend should be liable to serve when called upon." This proposal was, however, abandoned as unpopular. It was more popular to praise the seaman and to neglect him. The country, alarmed for its liberties, first by the presence of Dutch troops, and next by the growth of a standing army, took keen interest in the soldier; chiefly because it was afraid of him. Parliament insisted on annually reviewing the military code, the condition and treatment of the soldier. The Navy was not, could not, be a danger to civil liberty. No free-born Briton, who could avoid the press-gang, feared it, and therefore Parliament paid little or no attention to the naval code, or the condition and treatment of the seaman. When a naval operation did not satisfy public hopes, an Admiral was shot. When seamen were poisoned with loathsome food, fraudulently supplied, but little notice was taken. England was determined to have naval success, but troubled herself little to devise systematic means of attaining it. When fleets had suddenly to be manned, men were forced on board to be "their country's pride," whether they liked it or not. Neither the country nor the Parliament cared very much to look below the surface of naval affairs.

It was, however, becoming apparent to naval Officers of that period that a nucleus of disciplined men, trained to accurate use of weapons, was necessary in a ship-of-war, filled by force with untrained men, so that by "their expertness in handling arms they might incite our seamen to the imitation of them."¹ What a seaman was in those days it is really very hard now to say. In these days of steam and mastless ships a suggestion to use the Army as a nursery for seamen would be ridiculed; yet so far back as 1739, in days of purest seamanship, we

find Admiral Vernon urging "the necessity of converting most of our marching regiments into marines, and if, as they became seamen, they were admitted to be discharged as such, that would make a good nursery for breeding them."

The advantages of system in the fleet of France was becoming apparent to our naval Officers, who were casting about for means to remedy the most glaring defects of the English Navy. To look to statesmanship for naval reforms was hopeless, to return to military interference in naval command was impossible; so when the pressure of preparation for war came in 1755 an expedient was resorted to in order to satisfy internal naval wants. It was to create military depôts from whence might be drawn as few or as many soldiers as ships might require to provide for deficiencies in numbers, true discipline, and efficiency in the use of arms. By abandoning the former regimental use and application of marines, the inconvenience of friction between naval and military authority would be avoided, and the Navy could thus reap what was sown by military Officers and Army training without being hampered by military interference of Officers of rank in the use and application of soldiers to naval purposes afloat. Hence when marines once more came into existence in 1755, they were not raised by regiments, but by companies, and formed into divisions or depôts at Portsmouth, Plymouth, and Chatham. The purchase of commissions was abolished, but interchange of appointment in the Army was for a time permitted. Soon even the practice of notifying in the "Gazette" the appointment of Officers in the marines fell into disuse, and later on the vacancies created by Officers killed in action were often for long periods left unfilled. What the Navy wanted was men not Officers, but still in landing operations it could not do without them, and even Officers were required afloat to keep their men expert in arms and to prevent them losing their military characteristics essential to their value. It was all-important that the marine should not degenerate into habits which his presence was to correct by example. The professional naval Officer, having wrested naval command from military hands, had no notion of jeopardizing his authority, but the country, having denied the Navy system, organization, or means of instruction, naval Officers were compelled to look outside their own service for the means to keep the Navy together and to perform its functions as a fighting force. In this strait they called on the soldier to help them, while suppressing as far as was practically possible both the military Officers and the military system of which that soldier was the product. The use and application of marines thus became wholly subordinated to internal naval requirements. They were the only individually and carefully trained men in the fleet, the only instructed fighting force which the country placed at the disposal of naval Officers.

During the last half of last century England was, except for a few brief intervals, at war all over the world. Sometimes she "fought for empire, sometimes she struggled for existence." Her fleet was ever increasing, but her policy was still not to attract, but to compel service in the Royal Navy. She denied to it what she was careful to

provide for her Army—system, means, time, and opportunities of instruction. The soldier's interests she looked after, of the seaman's she took but little heed. The marines, being soldiers, thus became possessed of individual rights and benefits from which the men of the Royal Navy were excluded. Thus marines could be obtained by voluntary enlistment, and after being carefully disciplined and trained, were freely used to force unwilling civilians on board the King's ships and to keep them there as Royal seamen. Thus the firm bayonets of the marines became the foundation on which rested the exercise of naval authority and the discipline of the English fleet. From being a useful fighting auxiliary adapted to naval wants the ever-accumulating naval necessities during the last half of last century transformed the marines into guardians of naval law and order. This change was gradually developed by the circumstances of the time. It was unobserved by the nation until it was complete. The century was about to close. Our great sea victories had confounded our enemies and amazed the world. England, girdled with a mighty fleet, feared nothing, when a thunderbolt, descending from a clear sky, plunged the nation in terror and dismay. The Funds fell with a crash, for—the seamen of the fleet had mutinied! With marines sitting on the safety-valves, naturally enough, no single sign nor warning of coming explosion was visible to the Officers of the fleet. The extent of the damage could not, in the panic and confusion, be at once ascertained. Perhaps the naval boiler had burst. Calmer survey, however, showed that the damage was not really great, though naval Officers had been thrust on shore and the marines overpowered. The seamen were ready to return to duty "if the enemy's fleet put to sea;" the marines did theirs regardless alike of the external danger and of the internal revolt. So military system, discipline, and training, triumphed over naval confusion. The Parliament which had denied the Royal Navy system and the seamen reasonable conditions of service was now compelled to bargain directly with the seamen, and matters were arranged between them, while naval Officers looked on. But from that hour marines came to be openly regarded as *the* reliable element in the fleet, a national necessity in use and application as the great police of the Navy. A great naval Officer, who, some years after the above events, suppressed with dauntless courage mutiny in his fleet while off the enemy's coast, described the marines as "England's sheet anchor." Well he might, for in those hours of his sorest trial he had found them his. It should be recollected that the tradition that a force of marines is necessary for police purposes in a ship-of-war comes down from times like those, and originated in days when seamen were obtained mostly by force and restrained chiefly by fear, when Captains visiting sick seamen in hospital on shore were instructed "to punish" ill-conducted patients, agreeably to the rules of the Navy, taking a boatswain's mate with them for the purpose,"¹ and when "the convalescent men" on board ship were ordered "to be employed picking oakum."²

¹ See orders of Lord St. Vincent.

² *Ibid.*

Thus the last century closed on our Navy. Turning our eyes to France, she had developed her naval system and provided for her seamen waiting for embarkation comfortable naval barracks on shore,¹ while English Admirals were uselessly pointing to "a horrible scene of profligacy and debauchery" on board our harbour hulks, which were the dépôts for our seamen.

At the commencement of the present century the marines were all infantry. In 1802 they were made a Royal corps at the earnest request of Lord St. Vincent, and it is a curious fact that delay in making the official announcement of that distinction arose from an unsuccessful struggle on the part of that great sea Officer to have inaugurated a new departure in the war arrangements of the country. It was this, that simultaneously with the order making marines "Royal," should be published another, "making service afloat as marines a part of the duty of every regiment of the line in rotation." This furnishes another proof that the "sea-legs" theory has come in with steam, and in days of pure seamanship it was not thought soldiers required much sea training to make them efficient as marines.

Science was slowly improving artillery, and a new naval want consequently came to be felt, viz., artillery knowledge. Once more the old expedient of turning to the Army for aid was resorted to, and detachments of Royal Artillery were embarked. The Naval Artillery School of France had been founded about a hundred years before our Navy in its distress called on land artillery to come out on the sea and help it. Much the same causes which broke up the marine regimental system produced so much friction that the Royal Artillery had to be withdrawn, and at the suggestion of Nelson, a new service, the Royal Marine Artillery, was created in 1804. This corps was organized out of Officers and men picked from the Royal Marines, then 29,000 strong, and after careful training and instruction in artillery became the one and only scientific artillery nucleus of the whole Royal Navy. Unregarded by the nation or the Navy, this was the corps which quietly and noiselessly pioneered the way for the march of naval gunnery progress. Its work produced in 1832 a purely naval gunnery school, the "Excellent," where selected naval Officers and seamen were put through a short course of artillery instruction. This establishment still exists, but much developed and carefully improved.

The Marine Artillery was then thought to have sufficiently cleared the way for the Navy, so it was abolished, and the corps of which the conqueror of Scinde had written, "Never in my life have I seen soldiers like the Marine Artillery,"² was unceremoniously turned out into the streets of Portsmouth. The Royal Marines thus once more became a single corps of infantry. Repentance quickly followed the act of abolition, and the experiment of 1755, as regards the whole marine force, was at once repeated in another and smaller way in respect of artillery naval deficiencies. It was to organize com-

¹ 1786.

² "Life of General Sir Charles James Napier."

panies of "Marine Infantry Artillery," and two were formed. They were not permitted to assume even the name of the old corps they represented, but were unobserved to do pretty much the same work. These companies grew in number and in strength, and in 1841, to qualify as an Officer of the artillery companies of Royal Marines required a longer time of preliminary preparation at the public expense, and passing a higher theoretical standard of scientific knowledge than was obligatory on any combatant Officers, gunnery or otherwise, in the entire Royal Navy. These artillery Officers in official disguise were sometimes employed as gunnery Officers of ships, sometimes as simple marine Officers. It was a matter more or less for the discretion of Captains of ships. The non-commissioned officers and men were freely used to fit gun gear and to teach the seamen gunnery, just as corresponding grades in the infantry companies taught seamen the use of small-arms, and to drill as soldiers. The marines had by 1850 thus added to their uses and applications. At this date the non-commissioned officers and men, being soldiers, had, following in the wake of the Army, obtained many solid benefits and attractive advantages, still denied to the petty officers and seamen of the Royal Navy. The Army, at the commencement of this century, had been granted a system of continuous service, which was subsequently always in a state of progressive improvement, and in which marines by degrees participated. The Royal Navy had in 1850 no continuous service system. Its peace demands for men could be supplied without actual resort to physical force. To serve the Queen at sea, men had no longer to be dragged, but sometimes to be drugged. Instead of being seized in the open streets by the "press-gangs," they were cautiously cajoled in grog-shops in the back slums. Newly commissioned ships, with a careful assortment of naval Officers and full complements of marines, thus making complete all appliances for discipline, often waited vainly for weeks without tempting sufficient numbers of blue-jackets to walk in. When filled up the ship proceeded to sea, and at the end of the commission spent in training and disciplining them, the blue-jackets were cast adrift, while the marines returned to their barracks to get a furlough, and then to be re-trained by their own Officers to make them fit for re-embarkation.

The year 1853 witnessed the first touch of broad true statesmanship to the Royal Navy during that long period over which we have travelled, of 188 years. The Naval Continuous Service Act of that year placed the Royal seaman—as regards conditions of service—on a level with his comrade the British marine. Thus a new chapter of naval history was begun just thirty years ago.

During the Baltic and Crimean Campaigns a portion of the artillery companies was specially used and applied under the command of its own Officers in mortar-boat flotillas. For many reasons the Navy was incapable, at the time, of fulfilling this requirement, so the force was put to do the work which in 1804 the old Marine Artillery had been created to perform. In 1859 these companies were formed into a separate division, and in 1862 into a separate corps, and given back

the old name Royal Marine Artillery. Thus the marines became once more forces composed of two corps.

In 1858 a Royal Commission was appointed to enquire into the best means of manning the Navy, and on its report, the following year, is founded our naval system as it exists to-day. The chief representative of the mercantile marine on the Commission declined to sign the report, and set forth his reasons and his views separately. His objections to the report were that various important facts had been overlooked or treated as of secondary importance. The first and foremost fact was, in Mr. Lindsay's opinion, this:—"That the introduction of steam had entirely changed the mode in which naval warfare would in future be conducted." It is extraordinary that the Report of the Commission on which is based our naval system of to-day ignores steam utterly. Even the word "STEAM" is not to be found in the whole report; this is worth particular notice, because another Royal Commission on "The Defences of the United Kingdom," sitting at the time, devoted a lengthy paragraph, explaining that steam had "revolutionized naval warfare." The Manning Commission, however, expressed the opinion that it was improvements in gunnery which had "effected a complete revolution in naval warfare,"¹ the consequence being that the present perplexing naval problem is—how to fit into a steam navy a makeshift organization adapted to a sailing navy? It is a large question, and I would refer the uninitiated to the most valuable prize and other naval essays published² last year by this Institution, and also to the report of the discussion on them, which will be found in the Journal.³ We can only consider one portion of the problem—the use and application of marines. On this point the Royal Commission report throws practically no light. Though it examined seventy-nine witnesses, not one single Officer of Marine Artillery or Marine Infantry was called. A pay sergeant was asked some questions about pay and clothes, and that was all the direct evidence given on behalf of artillery and infantry forces on which the Navy relies, and numerically far greater than the total force which marched under Roberts from Cabul to Candahar. A single special paragraph in a very voluminous report of twenty-one pages finishes off marines in four sentences. The first sentence is simply this: "The marines are a useful and efficient body of men, second to none in the service of the State; they are excellent troops, both as artillerymen and infantry, and are at the same time capable of performing many of the deck duties of a ship-of-war." Since that vague sentence was penned, steam has quietly tumbled *all* duties in modern ships of war down to the deck, thus correspondingly altering the qualifications of men required to fight them. The second sentence in the paragraph of the report devoted to marines is as follows:—"There is, however, a limit beyond which they cannot be conveniently increased, for it is necessary to their efficiency that they should spend a large portion of their time afloat." What proportion it does not say. The third

¹ *Vide* "Report," page 11, para. 32.

² *Vide* "Journal," vol. xxiv, No. CXIV, page 183.

³ *Vide* "Journal," vol. xxiv, No. CXVII, page 593.

sentence states that "there is ordinarily a reserve of 6,000 marines in the home ports ready for active service afloat," which was not and is not the case; and the fourth and last sentence recommends an increase of the force—it does not specify whether the Marine Artillery or the Infantry, or both—by 5,000, and which recommendation has not been acted upon. Thus the first sentence tells nothing definite as to use and application, the second is mysterious, the third is incorrect, the fourth and last has been ignored, and therefore the whole paragraph is valueless for practical purposes now. Thus were the marine forces officially launched blindfold into the future of that reconstructed Navy, which dates from that report. On the other hand, Mr. Lindsay, taking the ground of alterations caused by steam and "mechanical contrivances," and his personal knowledge of the mercantile marine, refused to sign the report, and advocated a comprehensive application of marine forces to the purposes of modern naval war. Before, however, discussing matters of opinion as to the use and application of marine forces, it is necessary to complete the series of facts.

The last point we noticed as regards education of naval Officers, was the founding of the Naval Academy in 1729. The name was changed to the Royal Naval College in 1806. The establishment was closed in 1837. In 1839 it was re-opened, not as formerly a place of preliminary education for young gentlemen entering the Navy, but for the scientific education of a certain number of Officers. It was here the Marine Artillery Officers were educated as scientific Officers at the public expense. This establishment gave way to the existing Royal Naval College, Greenwich. Candidates for commissions in the Royal Marine Artillery have first to qualify at the entrance examination for the Royal Military Academy, Woolwich, they are then attached "on probation" to the Royal Naval College, Greenwich, for two years, and must pass a series of examinations before obtaining their commissions in the Royal Marine Artillery. The theoretical scientific standard to qualify for a commission in the Royal Marine Artillery is higher than is obligatory for any combatant Officer of the Royal Navy, and I believe more than half the Officers on probation to so qualify, fail to pass it. The cost of such education at the College is defrayed by the public. Officers of both branches of the marine forces are, under certain conditions, allowed, in common with naval Officers, to study voluntarily at this establishment, and their expenses while so doing are at the public charge. Officers of the marine forces are further permitted to study and to qualify at the Staff College of the Army. This is also at the public expense, so these Officers, one way or another, cost a considerable sum of public money for their scientific and professional education. It takes about three and a-half years of an elaborate course of study and practical artillery training, at the expense of the State, to turn out an effective Marine Artillery Officer ready for service. He will then be about twenty years of age, and for pay alone he will have cost the country about 350*l*. The time occupied in training an infantry Officer is some eighteen months, costing for pay about 150*l*. He will also be about twenty years old when fit for service. The limit of age for candidates for admission to the Naval College to

study "on probation" for the Marine Artillery, is from 16 to 18—for a commission in the infantry from 17 to 20. The education of an executive or combatant naval Officer, at the expense of the State, begins with the child entering his teens on board the "Britannia"; two years after, it places him as a midshipman in a vessel of war, nominally as an Officer, really as a "school boy."¹ "His intellectual advancement," we are told, "during the most valuable interval between the ages of 15 and 19, has comparatively ceased, and that period may be considered as one of mental inactivity." It is not easy to say exactly what the pay cost of a combatant naval Officer has been when he arrives at the age of twenty, but, so far as I have been able to ascertain, I think it may be taken at a figure considerably less than that of the Marine Artillery Officer of the same age, and at more than the cost of an Officer of Marine Infantry. If examinations be any test, and if the naval account of the naval Officer's education as stated by naval Officers themselves, be at all correct, one thing is clear, viz., that the Marine Artillery Officer at twenty must be the superior of the combatant naval Officer of the same age in general knowledge, in scientific attainments, and in practical artillery training. This relative superiority is not of course due to anything else but the process to which the young men are respectively submitted, and by which they are tested. The State has thus arranged it, and bears the cost. As regards the infantry Officer of twenty, he ought to possess more general knowledge than his naval comrade of the same age, if naval Officers are right as regards their own educational system, but most certainly he knows thoroughly how to command men fighting as infantry, and is therefore far and away the naval Officer's superior in that particular respect. About, or soon after twenty, the naval Officer is put through a course, theoretical and practical, at the College and on board the "Excellent," and must pass a certain standard before receiving his commission as a Lieutenant. Thus, at the age when Marine Artillery and Infantry Officers are embarked as trained Officers in their respective branches, the naval Officers are disembarked to complete their professional education.

Present.

Now, as to use and application. It is not necessary to refer to marine forces when serving as part of the Army. Their duties as compared with the Army are identical, they are applied precisely in the same way under equal conditions and on exactly the same footing, being under their own Officers and under the Army Discipline Act.²

For example, quite recently in Egypt the Royal Marine Light Infantry formed an integral portion of the military force; while the Royal Marine Artillery, besides serving as infantry during the campaign, detached men to work the guns of the Royal Horse Artillery when the R.H.A. gunners were exhausted with over-work and fatigue;

¹ *Vide* Naval Prize Essay, by Captain Lindesay Brine, R.N., "Journal," vol. xxvi, page 210.

² The first Marine Mutiny Act (Annual) was passed in the reign of William III.

subsequently another detachment built up, out of the *débris* of the enemy's Krupp guns captured, one complete gun and fought it with effect, and finally the whole force of Royal Marine Artillery was employed as corps artillery, and entrained, &c., the guns captured at Tel-el-Kebir.

When, however, Marine Artillery or Infantry Officers are landed as part of a naval force for fighting on shore they are under the Navy Discipline Act and the command, direction, and control of naval Officers. So that Officers, carefully and specially trained by the State for military operations on the land, are placed in the face of an enemy under the guidance and direction of Officers carefully and specially trained for naval operations on the water. The gunnery duties of the fleet are performed by naval Lieutenants who have undergone special training and examinations to qualify for the position. When afloat the Marine Artillery Officer has no distinctive general artillery duties in the fleet. Their superior education and practical artillery knowledge, acquired at the expense of the State in order to fit them for duty as naval artillerists, are for general naval purposes neither used nor applied. A Major or Captain of artillery, expensively educated as such, and who may in pay alone have cost some 3,000*l.*, is simply, when embarked, an irresponsible spectator of the artillery work of the ship or fleet. The Marine Infantry Officer in like manner, educated at the public cost to be a carefully trained instructor in the use of arms and infantry drill, looks on, doing nothing,¹ while the naval Gunnery Lieutenant is teaching small-arm parties these very things. The duties afloat of Officers of both corps are confined to their own men, and only then when the general duties of the ship permit.

The Royal Navy may be grouped under two heads, viz.:—Combatant and non-combatant. Neither Officers nor men of the non-combatant division can be regarded as trained to arms, capable of defending their own ship, for taking an enemy's, or of landing as an organized force. More need not be said here about this division, except that about three-sevenths of a ship's complement is non-combatant, and under existing arrangements it is an increasing element. The combatant branch is the only trained fighting element in the Navy, apart from marines. As regards men, there are but 20,000 borne for service in the fleet, and this number includes petty officers. There are in addition 4,000 held in reserve in the Coast-guard. The total number of combatant commissioned naval Officers over twenty years of age of all ranks on the active list² is somewhere about 2,000, so that the total combatant or trained fighting element in the whole Royal Navy may be roughly computed at or about 26,000, all

¹ "There can be no doubt whatever that the enforced idleness of Marine Officers afloat is most prejudicial to both services, and we need ask ourselves can we, in ships of the future any more than in ships of the present day, afford to have Officers afloat who have no defined duties? It is a very remarkable point, one of the most curious things in the whole of our naval discipline, that the 'Queen's Regulations' and the 'Admiralty Instructions' contain no instructions on that head at all."—Commodore Goodenough. "Journal," vol. xv, page 493.

² On full or half-pay.

ranks. As regards marine forces, the rough numbers I have given, namely, the artillery corps, 2,532; the infantry corps, 9,826; are all fighting men and include all ranks. There are about 90 Officers of artillery and some 250 infantry. So that the total specially trained fighting forces of England for sea service are about two-thirds naval and one-third marine. It may be remarked in passing that there are three Naval Lords of the Admiralty, but no Marine. There are generally between 6,000 and 7,000 of these troops afloat, and if from the balance on shore, the drill staff, &c., and men in process of training, be deducted, there are ordinarily between 3,000 and 4,000, "ready for active service afloat," and not 6,000 as stated by the Royal Commission. The available reserve of marine forces, therefore, may be taken at something numerically less than the Coastguard.

The conditions of service as regards time, pay, and pension are now rather better for blue-jackets than for marines. To the actual cost of maintaining 20,000 seamen and 4,000 Coastguard, and providing pensions, must be added the cost of training 5,000 boys to keep up the supply, and these are non-effective as fighting men until they have grown to be men. The State incurs no such preliminary charge on account of marine forces, for only men are enlisted in the ranks. From the date of enlistment, it takes about two years to make a marine artillery gunner, about one year to make a marine private.¹ Not many gunners of marine artillery and privates of infantry have completed training and embark before they are twenty-one years of age. On the other hand, the Naval Prize Essay shows that of the total 20,000 combatant seamen borne for actual service in the fleet, some 9,000—nearly half—are not over twenty-one years of age. The important element of fully matured manhood in a fighting force is greater therefore in the marine than in the naval combatant portion of the fleet. The men are chiefly used and applied afloat as sentries, and next, to such general work of the ship under naval Officers as may be required. These men are supposed to be placed at the ship's guns in such a manner as will least impair the efficiency of the arrangements for action in case they should be landed, the marine artillerymen being given the most important numbers. This is an elastic general rule, variously interpreted. When the carefully trained and re-trained gunner embarks, perhaps for the third or fourth time, it is uncertain whether he will be put at a gun, and 'if put, he may find himself in a subordinate position under a young blue-jacket, as captain of the gun, who has not *been so long at sea*. The reason of this was explained by Admiral Sir T. Maitland (afterwards Lord Lauderdale), who had been for many years the head of the Gunnery Department of the Navy. He stated to the Commissioners: "I consider the marine artillerymen the most valuable men in Her Majesty's Service, and also the marines; but still the marine artilleryman, I think, is totally thrown away on board ship; for if we can get a seaman capable of being captain of a gun, we put him to it because we do not like the guns of the Navy taken out of our hands; and the consequence is

¹ Officers and men of the infantry are carefully instructed in ship's gun-drill as a part of their training previous to embarkation.

that a marine artilleryman, except when sent ashore with a field-piece, very seldom does his legitimate duty.”¹ The machine-gun now often supplements the field-piece in naval operations ashore since that evidence was given. As a matter of fact it is seamen, not marine artillerymen, who are sent on shore from a fleet with Gatlings and field-pieces, and therefore, neither ashore nor afloat with naval forces does the marine artilleryman do his legitimate duty for which he has been trained at the cost of the nation. Now the Royal Commission of 1859 does not seem by their report ever to have understood that there was a specially trained marine artillery force. In the absence of any witness belonging to either branch of the marine forces they were naturally uninformed. For example, Admiral Sir A. Milne was asked: “The question is whether you can train the marines to fight the guns as well as sailors: what objection would there be to substituting marines for sailors?” His reply was, “Because you would not have a sufficient number of seamen to go aloft!”² If this answer be applied relative to working the guns of a mastless ironclad of the present time with no “aloft for seamen to go to,” where are we? I say boldly, and at once, I entirely sympathise with naval Officers in disliking to have “the guns of the Navy taken out of their hands.” I perfectly understand their feelings and applaud them for their “*esprit de corps*,” but it is impossible to believe that our national system can be anything but most false, to tolerate the misuse and misapplication of the public money by the creation of a corps of splendid land or sea artillery for the distinct and settled purpose of allowing it to be “totally thrown away on board ship.”

It is now time to compare the past with the present. We have seen that the origin of marines was due to political causes; these have wholly disappeared. We have seen that the original application of marines was for offensive operations on land in days when war-ships carried the military force. In these days, military forces are moved for offensive operations in special swift steam transports, for modern men-of-war cannot carry them. The military arm was introduced into the Navy to check fraud and corruption, but fraud and corruption have long since utterly disappeared. Marines were raised in the time of William III to feed the Navy: that use and application failed. During the reigns of Queen Anne, George I and II, numerous regiments of marines were raised only for war, and were carried in war fleets to seize, hold, or defend important positions commanding the sea. War ships have not now the space available, and cannot carry bodies of marine forces over and above their complements for that special purpose. If they use the fighting portion of their complement to hold or defend such portions, they are tethered to the place for want of a fighting force on board. The next use and application of marines from the time of George II down to the end of last century was to put supernumerary fighting men into ships capable of carrying them, and, at the same time, to provide “sealed patterns” as it were “of expertness in the use of arms to incite seamen to the

¹ *Vide* Minutes of Evidence, Question 5623. Manning the Navy.

² *Ibid.*, Question 147.

imitation of them." Now the ships cannot carry supernumerary fighting men, and as we have seen the young seaman is put captain of a gun "to incite" the old trained marine artilleryman to the imitation of *him*, while it is not an uncommon occurrence for marine artillery and infantry men to be left on board to take care of the ship, or in rear on shore, while seamen are pushed up to the front in naval brigades with the Army. So from inciting seamen afloat "to expertness" by marines, we have got to seamen "inciting" marines ashore.

From the end of the last century down to a time not possible to define, the marines were, and perhaps by some few still are, regarded as the police of the fleet. Since, however, the conditions of service of the seamen are now as voluntary and are rather better than those of the marines, and as the seamen are trained from boyhood, while the marines are men when they enter, that use and application of marines is wholly a dream of the past. If blue-jackets, trained from boyhood, cannot do the simple ordinary duties of guards and sentries on board their own ships, they cannot perform that commonest element of military duty on shore; and if that were the case they could not and should not be landed to serve with the Army in naval brigades in the presence of the enemy. Underlying, however, all past uses and applications of marines, there was one general reason for their existence, viz., the difficulty of obtaining sufficient men to man the fleet. War-ships were built rapidly by scores and taken or lost by dozens. Now war-ships take years to produce, and are built by ones and twos. Formerly war-ships were floating beehives, into which men were swarmed by the nation. Engines and machinery have turned out the men, and the chief difficulty now as to cost and time is ships—not men. Science has changed the relations between quantity and quality in manning the war fleet. Let us see how all this influences the present conditions of the Navy and Marines.

The marine forces have come to be described as a reserve for the Navy, for example—the Naval Prize Essay states, "the marines must also be considered as forming one of the main elements of our standing reserves." This is pure delusion. No body actually and continuously serving in peace with another force can be its reserve, therefore the 6,000 or 7,000 of these troops afloat in the fleet are not a reserve at all; of the remainder there are only between 3,000 and 4,000 which can be drawn out for active service. This number even cannot be regarded as available to meet a sudden increase in the fleet, for primarily it is the reserve to supply the waste in the 6,000 or 7,000 troops already afloat; besides, a very considerable proportion of these men are recruits, and have never been to sea. If then it be true that a man is not an efficient marine until he has spent "*a large portion of his time afloat*,"¹ these recruits must all be struck out of calculation. There will be then but a handful of men left. Thus the prevailing unthoughtful assertion that the "marine forces are the standing reserve for the Navy" comes to this: the country is spending nearly one million a year to have as a result a few hundred marines ready in

¹ *Vide* Royal Commission. Manning the Fleet.

barracks to meet sudden naval emergencies. But while it is so commonly and loudly asserted that a marine must spend a large portion of time afloat to be efficient, no First Lord, no naval authority, nor any one else has ever, so far as I am aware—authoritatively or otherwise—specified how long. What are the limits fixed by the modern “sea leg” theory, or by what standard is the necessary time to be measured? I commend that particular question to the naval authorities in view of the increasing difficulty of finding ships in which to train seamen.¹ Marines spend nearly half their service afloat, and while afloat occupy space available for seamen. Every hour they are kept afloat in sea-going ships longer than is necessary to attain efficiency, wastes corresponding space and opportunity of training seamen. Naval Officers demand sailing training ships in which to train young seamen, as they cannot be trained in ironclads. Before, however, the country can be brought to commission obsolete sailing ships in which to train men to fight modern mastless ironclads, it may wish to know why Marine Artillery and Marines should not man the mastless vessels, leaving the present sparred ship-of-war of a less advanced type to the seamen. Marine Artillery and Infantry who cannot go aloft are scattered over the globe in masted and heavily sparred ships, while naval Officers are complaining that “lads crowding” our latest ironclads who *can* go aloft are denied opportunities of doing so. One mastless ironclad chiefly manned by Marine Artillery and Infantry would, by disembarking and changing the men as fast as they became efficient, probably turn out more fully trained marine forces in a shorter time than a dozen sparred vessels under the existing system.² It is possible that the present use and application of marine forces is steadily deteriorating the seaman by keeping him in harbour hulks instead of at sea in sea-going ships. It is not impossible that under the existing system a large proportion of marines may have more actual sea service than the average of seamen. On this point there is no statistical information. As, however, of the 20,000 seamen 9,000 are not over twenty-one years of age, they could only have on an average about three or four years’ sea service, while marines of twelve years’ service would probably have six, about double the sea service of nearly every second seaman in the fleet. There can be no logical reason or justification for assuming that a seaman not over twenty-one years, and with only three years’ sea-going service, is more fit to fight great guns afloat or Gatlings on shore, than the carefully instructed gunner of Marine Artillery thirty years of age who has had double the sea-going service, and besides six years’ drill and instruction on shore. The naval system developed by the Royal Commission, intent upon arranging that marines shall “spend a large portion of their time afloat,” may have

¹ Twelve years ago the late Commodore Goodenough pointed out, “We have not got enough ships to exercise and drill even the number of seamen we possess.” *Vide* “Journal,” vol. xv, page 492.

² “The marine is a soldier who passes half his service afloat and half on shore, and by that means when war breaks out we get men who are efficient at sea, and in ships like the ‘Devastation’ we only require a few seamen to steer the ship, heave the lead, &c.”—Admiral G. O. Willes, C.B., “Journal,” vol. xix, page 614. The italics are mine.—[J. C. R. C.]

overlooked securing that seamen shall "spend a large portion of their time" at sea. This supposition cannot be regarded as baseless in the face of evidence of naval Officers competent to express opinions; for example, Rear-Admiral Sir M. Culme-Seymour has very recently stated as follows:—"I have been two and a-half years at Portsmouth, and, of course, thousands of certificates have passed through my hands. You would be surprised to see the little time out of the first five years that an ordinary seaman is at sea. It is hardly anything at all. There are numbers of ordinary able-bodied seamen at the home ports who, out of the first five years' service, never spend a year at sea."¹ Captain Noel, R.N., has also stated, "that young ordinary seamen have sometimes remained 'at Sheerness' for three or four years together."²

So much, then, for the past and present use and application of marine forces as regards chief features and relative results. Starting from a period when military Officers commanded professional naval Officers at sea, we have, by degrees, worked round to naval Officers commanding professional military Officers on shore. Curious indeed, would it be, if the expedient of a maritime regiment adopted over 200 years ago has produced in our own days many soldiers having more experience of the sea than half our seamen. Whether this be so or not, the history of the past and the present uses and applications of marine forces is the memorial of a Navy neglected by Parliament; of expedients substituted for a comprehensive naval system; and of a brilliant roll of services rendered to the Navy and the nation by generations of men, who, under the motto "*Per mare, per terram*," toiled in peace and fell in fight, unnoticed by the country they served so well. On no one flag could be inscribed the record of their services in war, and the melancholy distinction of their Officers is this—they did their duty uncheered by hope of personal reward, for naval interests barred their roads to fame.

Future.

It now remains to offer some brief speculations on the probable future use and application of these forces. The two centuries of their history have witnessed a stupendous change. The Island England of the seventeenth century is Imperial England now—but dependent on the sea for bread. Fitting it was that in the dawn of her Imperial day the colours of England's first maritime regiment should have displayed "the rays of the sun issuing from each angle," for now the rays of her civilizing light issue from each corner of the world. A Dominion in the West, an Empire in the East, an Australian brotherhood of young nations, a community of mixed races at the Cape, a host of possessions scattered about the world, a Suez Canal to be protected, and a possible Panama Canal to be watched, an aggregate Imperial revenue of some 160,000,000*l.* per annum ever increasing, though that of the United Kingdom stands still, and an Imperial sea commerce approaching in

¹ *Vide* "Journal," vol. xxvi, page 619.

² *Vide* "Journal," vol. xxvi, page 717.

value 1,000,000,000*l.* in each year, make up an aggregate of weakness open to attack, and sources of strength possible to defend only by combination. The cardinal principle of defence common to every portion of our Empire is the safety of the sea, and the most remarkable feature presented by our existing so-called Imperial preparations for war is this—that the necessity of combination for the defence of the sea is wholly ignored. In no sense is the Royal Navy Imperial. Some people who delight in high-sounding terms choose to call it so; their only excuse being that two naval cadetships are given to the Colonies in each year. India has an army; most of our great Colonies have local military forces; but with the exception of two or three, none have volunteer naval forces, and even these are simply for purposes of harbour defence. The burden of defending the sea is wholly borne by the United Kingdom, and therefore it is consistent with this fundamental anomaly that the whole naval structure, reared on such a basis, should be scamped. Our naval arrangements are in principle those of the Island England of the seventeenth century, and while an ancient sailing organization is endeavouring to squeeze itself into the modern steam fleet, the naval policy of an island is engaged in blowing itself out to imagine it has seeming Imperial proportions. Maritime war pressing on an Imperial sea-trade will, it is to be feared, teach us much we might have known before. For example, we may learn from bitter experience that absolute centralization of naval reserves and resources is not a sound principle on which to base preparations for world-wide sea warfare. That is the principle upon which we are acting, and which, I venture to believe, will fail us when it is put to the test. A belief in the absolute necessity for reversing that policy influences generally the conclusions which I am about to submit respecting the future use and application of marine forces.

In 1869 and 1871 I put before this Institution, in a series of four lectures, certain general principles of distribution and organization of our war forces,¹ and in those papers will be found, as regards the Army, theories, many of which are now accomplished facts; theories as regards the Navy, most of which are still theories—and chief of these latter was the absolute necessity for removing the Marine Artillery and Infantry from sea-going ships during peace and placing these forces while abroad at the British strategic ports. This paper is but supplemental to those which are now fourteen years old, and, therefore, those who wish for further information than time permits me now to give, will, I hope, find it in those papers. Evidence is not wanting to show the probability of this particular theory becoming a fact. Captain, now Admiral, J. C. Wilson some years later advocated removing marine forces from service as part complements in sea-going ships.² Captain Cyprian Bridge, R.N., in a very recent paper³

¹ "Distribution of War Forces," vol. xiii, No. LIII, and "General Principles of Naval and Military Organization," vol. xv, No. LXIV.

² "Seamen of the Fleet," &c., vol. xix, No. LXXXIII.

³ "Suggestions for Improving the Efficiency of the Personnel of the Navy and its Reserves," vol. xxiv, No. CXVII.

writes as follows:—"The practice of sending marines to sea—in rigged cruisers—and keeping ordinary seamen in harbour, is absolutely indefensible. It is, for strong language here demands no excuse, intolerably mischievous and should be abolished. There is not a single compensating advantage however small." The question, therefore, to which I shall now limit my closing remarks, is this—what will be the use of marine forces, and to what purpose, and how are they to be applied when removed from rigged cruisers?

The use of marine forces will, I take it, be:—

1. To provide reserves of fighting men for the Navy in war.
2. To furnish the nucleus of trained artillery and the fighting force of infantry for armed merchant steamers.
3. To provide organized bodies of troops for the attack and defence of minor sea positions, free and untrammelled by a complicated army system, ill adapted to the military necessities of naval operations.
4. To furnish the nucleus for local Colonial forces, especially those garrisoning naval bases in our Colonies.

Under existing arrangements, if war overtakes us there would not be found on any foreign naval station a reserve of fighting men for our ships. Casualties in action or by sickness could not be filled up on the spot. Reserves both of ships and men are centralized at home, and war will bring the concentrated pressure of demands for both upon England, and England only, simultaneously from every part of the globe. My proposal was, and is, to break up this centralization both as regards ships and men, placing the marine forces on the naval stations, but not as part complements of the active force of sea-going ships in peace. The objection—that were this done the marine forces would cease to be efficient as sea-soldiers, and become simply Colonial troops—like the French Marines—requires brief examination. It can be met in this way—by training them in mastless ironclads before they go abroad, by sending them abroad in slow ships, by keeping them only, as now, three years abroad, and when abroad by embarking small drafts in rotation for sea training during a cruise in the ships on the station. Six ships, carrying six men each in rotation, for a three months' cruise, would provide three months' sea training for every 144 men in each year.

For fighting armed merchant steamers in war, the marine forces stand in the precise relative value and are as great an Imperial necessity as they were in the past history of the Royal Navy. Sir Donald Currie, M.P., has pointed out in this theatre this application of marine forces to secure fighting efficiency in merchant steamers in war.¹ On a former occasion² I gave reasons for surmising that patrol and intelligence duties along the lines of Imperial communication would, in war, have to be done by mail steamers following their ordinary avocations, but armed and having a trained fighting nucleus on board. If, therefore, the guns, fittings, &c., and Marine Artillery and Infantry, in due proportions, were distributed at the ports of strategic import-

¹ "Journal," vol. xxiv, No. CIV.

² "Naval Intelligence and Protection of Commerce in War."

ance abroad,¹ where these vssels are perpetually calling in rotation, the equipment and men would have only to be shipped on the outbreak of war, and thus the great auxiliaries of modern naval power would be armed immediately and almost simultaneously all over the world. I propose, therefore, to throw the whole arrangement, at home and abroad, for arming, manning, and fighting the merchant steamers on the Officers and men of the Marine Artillery, the services of our scientific Officers and trained men of which force are now utterly unapplied if not wholly wasted. It is to be remembered this artillery service was created for the Navy, not for the Marines, and it is extraordinary that no steps whatever have been taken to apply it to general naval ordnance or torpedo duties, or to employ its Officers in naval Intelligence and Scientific Departments under either the Admiralty or War Office, or both.

It is hardly necessary to enlarge upon the necessity for Admirals having at their disposal a sufficiency of movable military force to seize and hold temporary positions during extended naval operations. The present army organization has excluded from view this naval requirement of our sea empire in war. Brigades, divisions, and corps d'armée, complete with field artillery and cavalry, are not suited to pouncing on an islet or sea position of an enemy in distant seas, and occupying it as a temporary coal depôt, or to seize and hold sea-girt rocks as ocean signal stations. The preliminary steps to using the Army thus, would be to break up its organization the moment war is declared. For this reason the marine forces are, in this respect, the sole remaining military prop of future maritime security on distant seas ; but war-ships cannot be used as of old to carry them, and, therefore, their true place is at the Imperial strategic ports abroad, where transport is always obtainable, ready to swoop down in swift steamers at the bidding of Admirals to take or to occupy such positions as maritime war may require. The necessity of marine forces for this purpose, so far from diminishing has enormously increased, but the mode of application to their specific object must be of necessity different.

Since I advocated here and elsewhere² a redistribution of our war forces two events have tended to show the grave mistake of Admirals abroad having no movable military force at their disposal. Parliament rightly cheered, and the nation justly applauded Captain Bradshaw, R.N., for carrying off in the "Shah" purely military forces stationed at St. Helena to meet emergencies in South Africa. England was pleased to find a man with pluck enough to defy the distribution system she adopts and sharp enough to cut clean through the trammels of her own careful weaving. She praised the man and sticks to the system, trammels and all, for the Army, not marines, still garrisons St. Helena.

Again, had the Mediterranean Admiral had a reserve force of marines at Malta, as I ventured to propose in former lectures here, is it likely Alexandria would have been bombarded without first moving them

¹ "The Defence of Great and Greater Britain" explains the necessity for this arrangement, page 27.

² "The Protection of our Commerce," 1867.

up? And is it likely that with a couple of transports of marine forces under a marine General within signal distance of the flag-ship, Alexandria would have been burned and British subjects slaughtered for want of a sufficient landing force at the Admiral's disposal? Not merely old arguments and forgotten theories, but recent facts combine to draw marine forces out of sea-going ships towards commanding positions on our Imperial roads.

Their future use and application in relation to Colonial forces requires very special notice, and I regret it must be rough and brief.

A Royal Commission has been sitting to determine questions connected with the selection of Imperial strategic ports, coal depôts, &c.; to suggest an organized system of defence for such positions, and to say whether "such defence should consist of permanent works, manned by garrisons of Imperial or local troops, or both combined, or of any local naval organization, or other armaments and appliances." The Commissioners had to deal with broad principles, not, as I understand, with details as to the nature and constitution of forces to be employed. It was, I take it, without their province to examine beyond the local positions and local requirements of Imperial strategic ports. There is no impropriety, therefore, in connecting the influences and causes on which I have dwelt with the general heads indicated by their instructions.¹ Those influences and causes render it necessary to place marine forces at strategic ports to fulfil requirements wholly unconnected with their local defence. Whether, therefore, Imperial troops are or are not, in the opinion of the Commission, required for local defence, Imperial troops in the shape of marine forces should be there for other and more general purposes. But these forces are specially adapted to manning, or teaching local military organizations to man, "permanent works," and are specially fitted and trained to supply, or to teach local organizations to supply, the fighting power of such vessels as may be necessary for purposes of local defence. Consequently, at whatever conclusions the Commissioners arrive, the marine service stands ready to fill up the details necessary to give effect to whatever general principles are laid down as best suited to the defensive wants of any strategic port. The question of extending their use and application to this particular purpose is a simple question of numerical strength, not of constitution. At ports where the Commissioners consider port defence vessels necessary, these vessels so provided would furnish the means for keeping marine forces efficient as marines. For example, there are at this moment two turret-ships at Bombay; there are, at the same time, scattered over the East Indian station in sea-going ships, marine artillerymen, doing probably every duty but their legitimate one. These turret-ships could keep efficient as sea artillery more marine gunners in one year than the whole East Indian squadron will, under the existing system, in three. The symmetry of our Imperial naval arrangements may be judged by the fact that while the Marine Artillery and Infantry on the station are

¹ The full text of instructions will be found in "The Defence of Great and Greater Britain," Stanford.

excluding seamen from sea service, these turret-ships at Bombay are manned by land artillerymen. Again, at Melbourne there is the "Cerberus," maintained at the cost of Victoria. That vessel would in one year turn out and keep efficient as many Marine Artillery and Infantrymen as probably the whole Australian station would in six. Possibly she might thus provide a training school for an Imperial service at Colonial cost, and similarly those vessels at Bombay might provide two others at India's expense.

In our great Colonies in which ports of Imperial strategic importance are situated, the application of local forces largely to provide for their local defence is a foregone conclusion, because that is the assumption on which our whole Army policy now rests. But the history of English local forces in the past, and the current history of Colonial forces in the present, are full of warning. Even our metropolitan Militia regiments, within a stone's throw almost of the Horse Guards, were found to require a *nucleus of staff drawn from the regular Army, and constantly changing*. Why, then, can it be for one moment assumed that local Colonial military forces without such nucleus, and shut out from the sight of regular troops by half the world, can remain vigorous or sustain efficiency? Australian local forces would not now be without a single nucleus of regular troops but for obstacles presented by Army organization. Before British regiments were withdrawn, the Colonies offered to pay for a certain number of Officers and soldiers, but the number they thought they required fell short of a certain unit of military organization as it then was. The unit, it was said, could not be broken, so, rather than pay for a greater nucleus than they considered they wanted, they let all the troops go. Thus was an Imperial principle sacrificed to an Army detail.¹ Hardly, however, had the last soldier turned his back on Australia when, for divers and sundry causes, the obstructive unit was numerically reduced below the number for which Australia was willing to pay. While, therefore, the military efficiency of British local forces in the Pacific was weakened, the home tax-payer became chargeable with that proportion of Army expenses which Australia had offered to bear. The organization of marine forces presented no such obstacles to giving effect to the wants and wishes of young British communities.² It would be a matter of indifference to its system whether a corporal and two men were required as a nucleus for a local artillery corps at the tiny island of St. Kitts, or large drafts of artillery and infantry, with due proportions of Officers, non-commissioned officers, and men, were requisitioned for similar purposes by the great British continent of Australia. From Canada, not so long ago, came a suggestion that Marine Artillery should be sent as a nucleus for the local defence of Nanaimo, the only coal supply depôt of the North Pacific,³ as the regular British force best suited to the purpose.

¹ See Australasian Parliamentary Papers, 1867 to 1871.

² See "Defence of Great and Greater Britain," page 240.

³ "Report of Minister of Militia, Dominion of Canada."

As regards the element of cost in this future use and application of marine forces, until the Royal Commission reports, no estimate is possible, but one or two matters may be borne in mind.

Taking 6,000 or 7,000 of these troops out of sea-going ships involves filling their places with seamen. How many additional blue-jackets it would add to the present establishment cannot be stated until it is known how many seamen are being spoiled in harbour hulks. When they are cleared off to sea we shall know what extra numbers are necessary. But putting 6,000 or 7,000 marine forces at the strategic ports abroad means dispensing with the active services of 6,000 or 7,000 of the regular Army now isolated and stagnating for long years at outlying commands. The proposal, therefore, broadly means a reduction of the Army Estimates, and a corresponding increase of the Navy Estimates. There would be more seamen and fewer soldiers; the total national charge remaining much the same. Possibly it might mean an increase of the marine forces without an actual corresponding ratio of increase of burden on the United Kingdom. The marine forces while serving at the strategic ports of India would be an Indian charge. The expenses of those for certain Crown Colonies would be reduced by Colonial contributions towards the Naval Estimates on which the marine forces would still be borne. Possibly some of the great Colonies would willingly bear the cost of such Marine Artillery and Infantry Officers and men as they desired to employ as staff and as a nucleus for their local forces, and it is a question of important detail whether transport expenses might not be less for marine forces than for the Army. These are all matters for careful inquiry, which would be premature until the Royal Commission has reported and general principles of Imperial and local distributions are fixed.

I have now endeavoured to sketch the use of marine forces in the past, their abuse in application in the present, and their possible use and application in the future. Not merely are the arrangements for the maintenance of English naval power in a transition state, but sources from which that power naturally flows are shifting from England to her Colonies; changes suggested by the march of science in the internal constitution of her war Navy can only be arranged in the shadows projected over her own individual power by that aggregate of British agglomerations which she now calls her Empire. Empire in truth and in fact it is not now, nor will it be, until all British resources combined furnish the means to be applied to the united British purpose of defending in war—the sea. A real Empire it can never be if the policy prevails of trusting the future of an old country to provide for the ever-increasing naval wants of great and growing British communities, unceasingly engaged in piling up a sea trade such, even now, as the world has never seen before. The policy of leaving it to time to produce something, we know not what, has, up to this, only produced increased weakness in the British naval position, nothing more. These are the beacons and the rocks ahead of England now, and to steer for maritime safety we must strain our eyes over the bows and not be casting longing glances over the stern.

The "seaman" may have to give way to the "steam-man." The organization of the marine forces of to-day may be the foundation on which will be laid the naval organization of to-morrow. But these are small questions compared with the problem of absorption of the naval resources of Great and Greater Britain into one British sea force. The first step towards its solution is for England to realize the facts of Colonial growth; the next to prepare for change. The chief *non-political*¹ difficulty in practical arrangements is to find a common denominator which would make combinations of fractional war strength possible. That common denominator may be found in Her Majesty's Marine Artillery and Infantry. Possessing organizations suited alike to help small Colonial naval or military efforts, or to meet great Imperial naval wants by land or sea, the path of transition from one stage to the other would be smoothed for Colonial Governments by the presence of these forces. Thus posted at the British outposts overlooking the oceans, serving as troops on land yet ready to patrol the sea, there would be one force, one organization, one uniform example of invigorating strength, whether numerically great or small, unceasingly circulating in one continuous stream from heart to extremities, and back again in three or four years, the very life-blood of an Imperial system. The chain of outposts along the Imperial roads of the world would, under marine command, furnish as well the Imperial staff, and be the territorial *dépôt* centres of instruction and organizing power on which would rest all local forces, and by which would be knit together in one common bond the war power of an Empire which has yet to come. Maritime power has its roots on land, and naval freedom relies on the military security of fixed positions, but military security does not ensure that the sea shall be free. The growth of Colonial trade is, in view of war, an increasing British danger which purely military efforts of our Colonies cannot avert. They, as well as the mother country, must prepare for change. From sympathy and common interest in that military force which serves on sea as well as on land, it would be but a glide for armed Colonial subjects of the Queen to follow its fortunes when war threatens their own trade, and beckons the marine forces to the oceans to serve, perhaps, in Colonial mail steamers for the protection of their own letters.

Canada and British South Africa, being exceptionally circumstanced, must rest for internal safety on an army system, but the war forces of all other Colonies, by being associated with the marine forces of England, would probably, from motives of economy and from sympathy, resulting from such association, gradually be drawn towards that regular service, and possibly might ultimately be affiliated with it, much as the local forces of the United Kingdom are now with the Royal Artillery and the Line.

And so, what marine forces have been to England in the past they may be to the British Empire of the future. They would at all events

¹ The great political difficulties I have pointed out in "Defence of Great and Greater Britain."—[J. C. R. C.]

bring to the task the accumulated results of two centuries of war and peace experience, and carry as their credentials to grander use and wider fields of application, their badge "The Globe," their watch-word "Gibraltar," and an inheritance passed on from generation to generation down to our own time, of duty—always done.

Lieut.-General LOWRY, C.B. : Although I do not feel myself at all competent to enter with any minuteness of detail into the varied and very instructive paper we have just heard, I think I shall carry the audience with me when I say that paper has been at once thoroughly suggestive, forcible, and practical ; and that it is of no small advantage to the country, and to the vast Empire of which it is composed, that a subject of such importance as that embraced in Captain Colomb's address this afternoon should be taken up and discussed by the Royal United Service Institution. I trust I shall have you with me, too, in this further remark—that it is well such large-sighted views as have to-day been opened out to us should not only go forth to our Colonies as tokens of the mother-land's abiding interest in them, but reverberate back again to this country the appreciation and reawakened interest and exertions for their own defence of the Colonies themselves. Time was, perhaps, when a lecture so fearless and outspoken might not have been looked upon very favourably by the authorities, but that time is past, and I believe this paper, and any such, will not only be welcomed, but gladly taken advantage of by those in office in the Army and Navy, and in the State in general. Let us hope, too, that ere long, men of the breadth of view, of research, and of resource of the author may be more directly made use of in some definite way by the State. Mr. Chairman, about twelve years ago, when commanding the troops in a garrison town in Ireland, I had an opportunity of daily witnessing what could be done by an Officer of the Royal Marine Artillery in training some 400 raw recruits, and it has ever since continued to me a matter of surprise and admiration with what marvellous power he moulded these young Irishmen in the narrow limits of militia training time into very fairly well-trained soldiers. Ladies and gentlemen, that Officer was Captain Colomb, and I need scarcely say, though we have but seldom met in the interval, I have followed his course—one of increasing knowledge and power—ever since with the deepest interest. And let me add that his is no infrequent instance of the more than ordinary capacity I have met, in my very limited experience, of Officers of the Royal Marine branch of the Service. I hope the subject developed in this paper may be thoroughly discussed, and that the suggestions put forward may reach all those lands which own our sway, and which naturally look to England for guidance and encouragement in the early development of their naval and military resources. I think Captain Colomb has admirably referred to the gallant corps to which he belongs—a corps often tried, and never found wanting—as "a common denominator," and it seems to me that no force could more fitly meet the necessities of the future in the matter of Imperial defence on the seas which margin our vast dependencies, and supply their and our needs, and in the harbours and coal depôts which equip them, than that of the Royal Marines. I am sure none could be better suited to do the work of training the volunteer naval and military forces of the Colonies, and that the more we develop that force in both its branches, and so employ it "*Per mare, per terram*" in time of peace, the better prepared will those so scattered but so vast dependencies be to stand by us and us by them in time of war. A paper such as this reminds us—and we need it—we have got to be prepared to compass in the day of danger the seas of the world.

Major BRIDGFORD : From this most interesting paper which the gallant Officer has just read, and which contains an immense mass of most valuable information, one is led to suppose that a marine is actually completely trained on shore, and that the artilleryman takes about three years to train, the infantryman somewhat less. Now, I think that the marine is not completed in his instruction until after he has been for at least one full turn of sea service on board ship. That carries with it an additional three years ; then when he returns to the shore he requires a revision of his drills, and that carries it on to something like a total service of seven or seven and a half years. This, of course, adds to the expense and time occupied in

the production of really efficient marines, and if the corps is to be used in the way indicated in this paper it would necessitate a very large increase in the number of annual recruits, also a large increase of facilities for training them on board ship. Without the training on board ship I repeat I do not think the marine is complete. The great difficulty that we have in the Naval Service of sea training the ordinary seaman equally applies to the marines, and if you abate one jot of the marine's sea training my experience and observation lead me to believe that he will, I do not say exactly deteriorate, but will be less perfect than he is at present.

Major ALEXANDER MAN, 3rd Batt. Gordon Highlanders: I wish to say a few words with reference to a point just touched upon by Captain Colomb, viz., the use of our marines in cases of sudden emergency on far off stations. It has been my good fortune to once benefit very much by such a use of these forces; and, as it was rather an uncommon instance, I will, Sir, take the liberty of mentioning it.

About eight years ago I was sent on very short notice to Chinese Manchuria to organize a police force for the defence of our Treaty port there, which was threatened by the banditti with which the province was swarming. In fact, our trade was standing still in consequence. I accompanied Mr., now Sir Edward, Malet, and soon found that there was absolutely no nucleus to build a force up with. I was there; arms were there; money was there; and there was a splendid fine race to get men from. But I had no non-commissioned officers to assist in training the men when got, so I turned round to think where I could look for help. To Hong Kong, naturally. If, however, I had written to the General there, who no doubt would have been most willing to have aided me, I could not, by any possibility, have had men before the ice came down and closed us in. The only thing, therefore, was to ask the Admiral—Admiral Ryder. He at once, without a moment's hesitation, sent me three of the Marine Artillery: one sergeant and two lance-corporals. I think they came from my friend Captain Philip Colomb's ship, the "Audacious." They were with me for about eight months, and I must say that I never saw such fine fellows. From first to last they took in hand under my orders, assisted by but two other Europeans, a couple of hundred or so Chinese and Manchus, and they picked up their language as they went along.

It is not for me here to say what we did with our little force: suffice it, it kept the port free.

Captain CURTIS, R.N.: I think the nation at large cannot be too thankful to Captain Colomb for exposing the present position of our maritime forces. With respect to taking the marines from the ships, we had a specimen in the "Albion." When the "Albion" went in under the Wasp battery at Sebastopol many of her crew were taken out of her, and she was considered to be in a state of demoralization on account of the inefficiency of the Officers and crew. I think there is a great deal in what Captain Colomb said, with respect to the small craft specially—that all the men on board small vessels should be seamen. I think that if marines have been three years at sea they should have twenty-six drill days, at least, on a vessel like the "Royal Sovereign." Admiral Martin, in the Mediterranean, when we were lying off Naples, ordered all the ships to get under weigh once a week. We got under weigh on general quarters days early, and returned back to the anchorage in the evening, when possible. We thought nothing of it. I think, after breakfast, the ship's crew might go on board a floating battery, take her out to sea, go through their drill, and come back again, and by so doing become very proficient. At Vancouver and other Colonies we should have two or three vessels of that sort, and that is where the Colonies might help us by subscribing towards our Naval Estimates. I think it is rather too much for the mother country to provide all the protection, and the marines, at the latter end of their service, might be engaged by the Colonies; and if they went there with their wives and families, they would serve as a nucleus force for the purposes of their defence. I speak more especially of Vancouver, because we may look upon that island as the England of the Pacific; and from what we generally read it is usually considered that foreign nations would not attack our Navy. It would be our Mercantile Marine that they would attack, and also our outlying Colonies; and the more extensive our Colonies, the more our Navy is weakened, because we have the more to look after or guard. Captain Colomb spoke of sending the marines out

once a week in their own ship. In former times the marines were not seamen; they were a disciplined force to set an example to the seamen, and, I am ashamed to say, occasionally to keep them in order. For instance, it is absurd to imagine that Blake, however clever he might have been, was a practical seaman. No doubt he told his sailing master or Captain to get as close to their enemy as possible, and afterwards to board him. I have been often told that in 1808, the master of a 38-gun frigate about to engage a Turkish squadron, consisting of a frigate, 52 guns, and corvette 26 guns, asked the Captain whether he intended to board the vessels or not. The Captain said: "I do not intend to board him, and I do not intend him to board me." The Captain did not open his mouth to manœuvre the ship; he and the First Lieutenant directed the guns. The sailing master manœuvred the ship the whole time; put his ship as often as he could under the stern of the enemy's vessel, in order to give her his broadside. The corvette was supposed to have been sunk and the frigate was captured. That was in 1808. The main point is that after the marine has been three years at sea he may be well depended upon to take charge of floating batteries, to work the battery guns, and put out to sea, perhaps twenty-six days in the year, to keep the men proficient in their duties.

Commander W. DAWSON, R.N.: I should have been glad if some Officer on the Active List had stated his opinion about taking marines out of a ship. Twelve or fourteen years ago I spoke very strongly in this Institution against taking marines out of a ship. I am not sure that circumstances have not so greatly changed since then that I am justified in altering the opinion I held in those days; but my opinions are not of much value, as I have not been afloat since then. Of course, what the naval Officers felt in those days very strongly was that the marines were a nucleus of discipline which would be useful not only in days of peace, but especially in time of maritime war, for when our Service becomes expanded to meet the exigencies of a great naval war, we shall be obliged to introduce into the Navy a number of untrained and undisciplined merchant seamen. That was a difficulty in doing away with the marines afloat which strongly impressed me in those days. Another point which I dwelt upon in that discussion was that naval Officers were deficient in knowledge of the details of discipline—deficient in capacity for giving effect to the chain of responsibility in the inferior ranks. I do not know what occurs now-a-days, but when I was afloat it was not unusual to see a Captain of the Navy, or a Commander, acting as a superior housemaid, and directing the operation of washing decks—a thing which the sergeant of marines would do on shore. There was no idea of a chain of responsibility—of putting the subordinate and petty officers in their proper places. I believe we have a good deal improved in all that, and that petty officers are trusted and held responsible for many subordinate duties, and I daresay it is possible that the marines might now be removed from the fleet without the heavy loss which we thought would accrue to discipline when I spoke in this theatre some twelve or fourteen years ago.¹ In other respects I think Captain Colomb has made out a very strong case for removing the marines from the ships, and sending them out in larger numbers in some of the mastless ironclads for the simple purpose of training. It is certainly a standing shame and scandal that we should have ordinary seamen going morally and physically from bad to worse in our ports, not able to get to sea, at the same time that we are sending marines to sea in ships. There are at Portsmouth and Devonport, and have been for many years, large bodies of ordinary seamen who cannot get ships to go to sea in, and those young men are contaminated morally and physically—not learning their profession in any way, and going altogether to the bad. Nothing can be worse than the naval system in that respect, and if Captain Colomb will show us

¹ I omitted to say what ought to be sufficiently obvious, that the sterling qualities of the Royal Marines, which have made them the admiration of successive generations of naval Officers, are not due to the source from whence they are recruited, but to the training and example of their Officers, whose invaluable services have received scant acknowledgment either from the Navy or from the Army.—W. D.

a way out of that, I think we ought to welcome any suggestion which will relieve us of that difficulty, and enable us to send these young men to sea, and get them into good sea training. Those are points upon which I should have liked to have heard some Officer on the Active List speak. There are several here present holding distinguished ranks in the Navy, and I am sure it would be good for the country that they should tell us openly what they really think about these points, because it is not a matter on which I can give any useful information, not having been afloat for many years; there has been very great moral and professional progress in the Navy in course of that time. The seamen at present are very different—physically, intellectually, and morally—from what they were when I went to sea; the system of naval discipline is not so imperfect, some general organization is beginning to exist, and, perhaps, Officers as a body are a little more enlightened and capable than they were, and know how to regulate the chain of responsibility, so that they do not put a Captain or Commander to wash the decks. All that may have altered, but one would like to hear from active Officers whether they agree with Captain Colomb's suggestion that the general organization of the Navy is yet such that the marines should be safely landed, and that the ships should be entrusted solely to seamen.

Vice-Admiral BOYS: It is extremely difficult, especially for a naval Officer who has not been brought up to take part in debates, hearing a paper read for the first time of this description, to rise up and criticize it, and take it in detail. For my own part I am not competent to do it, though possibly if I had it for a week or so I might be able to find some fault and discuss it fairly. There is one point, however, which I will mention. Captain Colomb has made, to a certain extent, comparison between the education and training of a naval Officer and the marine artillery and marine Officer. Of course he has taken his own view of it, and has, as he is perfectly justified in doing, coloured it in favour of the artillery Officer. I do not think he is quite correct in the conclusion that he draws—especially when he refers to the ages of the Officers. I think he says, "The marine artillery Officer, age 20, must be the superior of the combatant naval Officer, of the same age, in general knowledge." He draws his conclusion from their reports "in scientific attainments and in practical artillery training." We will take the naval Officer of 20, and the marine artillery Officer of 20; and I would ask which of those two individuals would be preferred by an Admiral or Captain commissioning a ship as a fighting Officer for the naval Service? It is only natural that the naval Officer should be the one, because he has been undergoing a practical education in gunnery and different duties at sea, as an Officer in boats and in command of men in various ways. I will not go further into details. Captain Colomb has given us an excellently written paper with quite a poetical *finale*, and the whole paper is full of suggestions; but there is one weak point in principle in it, and that is that he proposes that this "common denominator"—the marine Officer—should take the position of the naval Officers in instructing the seamen in various duties.

Captain COLOMB: No.

Admiral BOYS: If I am wrong I shall be happy to retract. That was my view of what was said, and in principle it would be a mistake.

Captain COLOMB: Oh, certainly.

Admiral BOYS: It is a mistake that Officers of one Service should take in hand the instruction and training of Officers of an entirely different Service. I have a great many friends in the marine artillery and the marines, and I look upon them as being as fine a body of Officers and men as can be found in the whole world. The training that the marine artillery Officer receives is a very superior one, and (I am only giving my own view on the question of *marines*) I must say that I think that we have now in our Navy really no place for the highly trained marine artillery Officer. In former days they might have been necessary, and they did a great deal in training seamen and Officers, who were more ignorant of special artillery duties than now. Now our naval gunnery Officers are specially trained for instructing. I can sympathize with the feeling of marine artillery Officers, that all their high training should not be wanted again in the Navy. While acknowledging again their superior qualifications, I would abolish the marine artillery, and would raise the standard of proficiency in gunnery somewhat; of light infantry I would only have

one corps. I would not have light infantry and artillery separate; but I would have one body of men, and revert to the glorious old name of the "Royal Marine." I do not think I can follow Captain Colomb any further. That is my own view of the case. I would not reduce the marines by one single man; but, on the contrary, I would increase them, for there is ample room for them in the Navy, and for our general defence.

General SCHOMBERG, R.M.A.: I hope I may be allowed to add a few words to the discussion, though I fear I shall be able to add very little to what I had the honour of stating, about fourteen years ago, in a lecture on this subject. I then said that the state of indecision in which the marine Service was existing was mischievous to the Navy and the Marines. That state of indecision still continues, with mischievous results to both Services. It is only three years ago that the marine artillery was threatened with destruction. Admiral Boys seems to regret that its destruction was not accomplished. In the Prize Essay of last year Captain Lindesay Brine stated that the marines are the chief reserve of the Navy; but in their present condition, and at their present strength, they are an utterly inadequate reserve. I believe I am stating the fact when I say that after the last detachment had sailed for Egypt last year, there were about 500 Marine Infantry and 100 Marine Artillery left in England, trained and available for embarkation; this was the strength of the chief reserve of the Navy. Admiral Boys seems to think that the Marine Artillery are utterly useless. I will ask him who are to be the gunnery instructors of the fifty armed merchant vessels that would have to be sent to sea in the first month of a great naval war? A struggle for the command of the sea is surely not an impossible event. The poorest countries in Europe are spending larger sums on single ships than we are, and one foreign Navy almost rivals our own in its number of heavy ships, so that a struggle for the sea is not impossible. Therefore there must be a trained and ready reserve for the Navy, and if the marines be not suited to the requirements of the modern Navy, abolish them at once, and give the Navy a reserve suited to its wants and requirements. A reserve the Navy must have, and a numerous reserve; not only a well trained reserve, but one adequate in numbers; and it is utterly inadequate at present. I believe the First Lord of the Admiralty said last year that the training of the Royal Marines left nothing to be desired. The Royal Marines were all very proud of the speech, and I must add a few words to it—that training is entirely the work of the hand and brain of marine Officers. But a perfectly trained reserve is useless unless it be sufficiently strong in numbers. I believe the only solution to this question is what is proposed by Captain Colomb, which I suggested fourteen years ago, and which Admiral John Wilson talked of eight or nine years ago, namely, that marines should form a very large portion of the colonial garrisons. Of course, if the marines are to occupy this position, they must be very much increased in number. There may be selfish interests to interfere with this; but if the marine be necessary for England selfish interests should be sacrificed. The question is, is he worth the sacrifice? and the sooner that is decided the better. In my opinion the marine service ought not to continue to exist as it is now constituted, because no State—not even a Venetian Republic—should retain Officers in its service whose future is doomed always to be perfectly hopeless.

Admiral BOYS: General Schomberg asked me a direct question. I think he is rather under a misapprehension. I did not intend to say abolish the marine corps. My intention was to amalgamate, not to abolish. And in reply to the question about instruction for the merchant ships, I say the crews would be seamen, and I do not see why they should not be trained by seamen Officers.

Major MOODY, R.M.L.I.: I should like to say a few words on the admirable and exhaustive paper we have just heard. I think it is an important point, although one of detail only, to settle how long a marine should serve afloat to become efficient, and how this service can be arranged. Provided the lecturer's propositions as to the future uses of marines are adopted, a large increase of the corps would be needed. To provide an adequate sea training without adding to the expenses of the fleet is to be considered. I take it about two years afloat is necessary on an average to make an efficient marine soldier, and to satisfy the sea-legs theory, which I consider a very important one. Without the sea training the force would simply become artillery

and infantry trained in naval gunnery, but without the self-reliance and adaptability which makes the marine forces so generally useful. Captain Colomb proposes to get this sea training by manning mastless ironclads with artillery and infantry marines, sending them out to their colonial duties in slow sailing-ships, and embarking men employed on colonial duties in the fleet on the station in rotation. This would no doubt provide training for a larger number, but I consider not sufficient in proportion to the general increase required. I propose that marines should be embarked when qualified as artificers and replace some of the large number of non-combatants now borne in sea-going ships, from 50 to 60 per cent. in some instances. A large number of artificers are enlisted in the marines incidently, many of whom are never utilized, and if it were known artificers were required I feel sure there would be no difficulty in getting sufficient candidates. Such men would be trained similarly as any other recruit, and be part and parcel of the marine detachment. The advantages of this system would be, first, a larger force of trained fighting men could be borne in sea-going ships, as the present artificers are entirely untrained to arms; second, room might be made for more of the blue-jackets proper, who are now kept in harbour ships; third, when any sudden increase of the fleet was required the marine artificer would be available for his legitimate duties, and artificers might then be entered from the shore as at present. From my experience of four years in command of 100 marine artificers employed in the dockyard and naval works of Bermuda, a system introduced by our Chairman, I believe, when Director of Admiralty Works, I found the work in no way interfered with their efficiency as soldiers. They were the smartest and best men I ever had under my orders. The only drill they had was two hours once a week at naval gunnery and one afternoon infantry. No more was required. I consider the more useful the corps is made, provided its splendid organization is preserved, the better it will be for the corps and the country. Few out of our Service have any idea of the many positions a marine during his service is called on to fill. The importance of training marines ready to supplement the scant crews and to supply the disciplined fighting force for armed merchant steamers is a point which cannot be too strongly urged. They are the only suitable men for the purpose, and should be available, as Captain Colomb has pointed out, at all stations where warlike gear for such steamers is provided; most of it might be placed under their charge. The most important point, however, introduced in the lecture is that suggesting the Marine Artillery and Marine Infantry should furnish the nucleus for local colonial defences. Too much weight cannot be attached to Captain Colomb's opinion on this subject. It is a question he has studied for many years, and is looked up to as an authority by the country. The marine forces are admirably adapted for this service, being accustomed to serve in small detachments all over the world, and so elastic is their organization, as he has pointed out, that it matters little the size or number of the detachments required, providing the numbers voted for the corps are sufficient, and the necessary amount of sea training is given. In this way the colonial portion of the Empire could be amply supplied with the nucleus of a fighting force with uniform discipline. If it is the case that the Colonies are losing touch with the mother country as far as warlike defences are concerned—different systems of discipline, and even arms, being introduced in different Colonies—the sooner such a state of affairs is remedied the better. It is simply courting an enemy's attack. Colonial service, in addition to their other duties, would be popular with the corps, as outlets could then be found for staff employment which the Horse Guards or War Office rarely give, and the want of which is so much felt in the corps. I am sorry no colonial gentleman has offered any remarks on this portion of Captain Colomb's lecture. I do not know men who are more suited to colonial life than the rank and file of the marine corps. The adaptability and self-reliance learned in their service afloat in early life adheres to them, and instead of these qualifications being wasted as at present in overcrowding the labour market in the neighbourhood of our seaports, it would be applied where it is required, and be appreciated in our vast colonial possessions all over the world. By allowing men to settle in the Colony where they may be serving on discharge, a valuable reserve would thus become available when required. I now pass to home defence. Considering the trouble and expense which is being taken to increase and foster the

Army Reserve, I cannot but think it is a matter of regret the services of the marines who have passed through the ranks are not utilized as a real naval reserve. Numbers of the corps, who by purchase, after twelve years, and invalids unfit for foreign service, &c., pass out annually, would only be too glad, for a small annual retaining fee, to join such a reserve were it organized, who are now lost as a body to the country. As a large number of these men reside within easy reach of the great naval seaports, there would be little difficulty in carrying out such a scheme. In conclusion, while thanking the large audience for the patience with which they have listened to my remarks, I consider the marine service is under a great obligation to Captain Colomb for his valuable paper, which must have taken so much care, time, and ability to draw up, and which he has come a long distance to read. It has drawn the largest audience I have seen in this Institution on one of the most inclement days we have had this year; an audience composed not only of numbers of representatives of the corps, but of other branches of the Service, and of civilians interested in the broad question of Imperial defence. As a serving Officer I also beg leave to tender our best thanks to the Chairman for the interest he has always shown in the welfare of the Royal Marines.

Captain BRIDGE, R.M.L.I.: Captain Colomb has alluded to a paper contributed to the Journal of this Institution by my brother, Captain Cyprian Bridge, R.N. In that paper he alludes to the employment of the marines for the colonial defence of our great Empire; but in the paper by my brother he apparently suggests that marines, when so employed, should be placed in very much the same position as they were the other day in the Island of Ascension, viz., under the Naval Discipline Act. I should like to ask Captain Colomb if he would tell us under which Act marines, if so employed in future, should be placed; and which would be most beneficial to national interests, and also to the employment of superior Officers of the Royal Marines. There is another question of the future, as to naval brigades. Captain F. Campbell, R.N., in a lecture delivered in this Institution last June, mentioned the position of marine Officers in naval brigades as more than anomalous; I should wish, as the employment of marine Officers and marines, in naval brigades, in the future is likely to be a question of everyday occurrence, if Captain Colomb would mind telling us what he thinks should be the position of marine Officers when so employed. He has told us here to-day the high training which the Officers of Marine Artillery and Light Infantry undergo, and also how well they have acquitted themselves as soldiers on all occasions, and if he would only enlighten us on the part that they should play when acting in conjunction with the Navy in naval brigades, I think some of us would be very glad to hear it. It is said that marine Officers cannot be employed on board ships of war in positions suitable to their acquirements, and that it is barely possible to make use of the talents and professional knowledge they possess when embarked; but when employed in land operations under the Naval Discipline Act, it would then be possible to place marine Officers in a position similar to what they would hold when acting in conjunction with the Army, and thus allow all ranks a chance of gaining the highest honours and rewards in their country's service.

Captain MACLEAR, R.N.: In confirmation of the suggestion by Captain Colomb as to forming depôts at foreign stations, I would mention that at nearly all our distant stations, the Pacific, Australia, China, and I think also the Indian stations, the ships are nearly always short of complement; and if this is the state of affairs in peace time, what will it be on a sudden call for war, when you require men not only to man the ships (and after the first action it may be assumed the ships will be still further short), but also to supply the requirements of arming merchant ships for defending the mail service and organizing naval brigades? It is certainly wrong that whilst our ships abroad are going short of men, young seamen should be deteriorating in our ports, unable to get experience at sea. This difficulty would be met by Captain Colomb's proposition to have depôts abroad.

The CHAIRMAN: Before calling upon Captain Colomb to reply to the various points that have been raised, I would venture to say, although perhaps few soldiers have been more in seagoing ships than myself, or have had to do with more Officers, both of the Navy and of the marines, from whom I have ever had kindness and support, yet into those questions touching any of the differences that

may arise on the relative relation between the seamen of the fleet and the marines of the fleet, I will not venture to express any opinion, although past experience may justify my holding an opinion of them. But I have a fair right to touch upon one question, and a very important one it is, which is shadowed forth in Captain Colomb's most valuable paper, and that is with reference to the future and extended employment of marines—I am perfectly indifferent whether they are called light infantry marines or artillery marines—but any body having the admirable organization, the admirable interior economy of the whole marine force—for colonial occupation and defence. This is not a new idea with myself, but I believe I can trace it back somewhere nearly twenty-five years ago, when the question of bringing away the regiments of the line from the various Colonies of the Empire was first started, and I think before a Committee of the House of Commons in 1858 or 1859, after I came back from Australia, I advocated the extension of the organization of the marines on some similar system to our Colonies as being the most efficient as it is the most economical system that the Empire could have adopted. The necessity for this has still more arisen in consequence of the new organization of our Army. In former years it was not unusual for a regiment of the line to go to a Colony and remain there 10, 15, or 20 years. Now, of the territorial system, of the short service system, I recognize the full advantages. Of course I know to a certain extent their weakness, but still to both systems I am myself an adherent; therefore I speak as an advocate of those systems when I say the introduction of the territorial system and short service into the regular Army in England, even had we no such organization as the marines—would necessitate our sooner or later creating that very organization, and I believe that instead of having a dark future for the marines as General Schomberg would lead us to believe, circumstances are now rapidly making it much more likely that there is a very good future for them on the extension of the same principles on which his grand old corps is formed. In our smaller Colonies, especially taking those Colonies most valuable to us, and at the same time most difficult for us to control and defend,—the whole of our Colonies to the Far East, reaching up to China,—I have always advocated and would advocate still, that the garrisons should be entirely marines. Regiments of the line, constituted as they are, are not the most effective agents now for colonial defence, and they are most expensive in those positions, requiring as they do large civil departmental corps to be attached to them to make them at all efficient. On the other hand, as Major Moody has just said, you can move the marines at twelve hours' notice, or less than that; without all the necessary departmental arrangements which are involved in moving a regiment of the line, you can remove them 10 or 20, or 500 or 1,000 miles, knowing that their organization is of such a character that wherever they may go they can take care of themselves. That in the defence of the Colonies is a point of great economic value. Their organization offers another very great justification for their being employed in such a way. An Admiral, knowing every place where they are, on difficulties arising, whether amongst a civil population or by the approach of an enemy's fleet, could at any moment reduce his other garrisons and increase his forces at the menaced point. In our separate commands correspondence must take place, the case must be proved, and valuable time is lost before you can move any portion of the regiments, especially in parts of the world I have just spoken of. If there was one homogeneous command over the marines stretching round the China Seas under one General or one Admiral, you would secure for the Empire a very efficient service, far more economical than the present one, and one which would especially meet the requirements of our colonial service. As we have exceeded our time, I will not detain you longer, except to say that to me, at the present moment, having the responsibility of advising the Government in reference to the question not only of the defence of our commercial ports in England, because I can see the application of this very question of the reserve of marines to assist in the organization of the defence of our commercial harbours as well as of our military harbours, but also in the question of the defence of our coaling stations abroad, I believe the marine organization offers a satisfactory solution of that question. This paper has come to me at a most opportune moment, and certainly, whatever may come of it, I shall always be grateful for having heard it at this time.

Captain COLOMB, in reply, said: I am sorry to say there is really little for me to reply to. Of course a lecturer in reading a paper before this Institution naturally takes one side, and I think if there is any good in him, or any good stuff in the paper, it ought to bring out the other side pretty strongly; with the exception of what Admiral Boys said on the subject, there has been no "other side" at all. I greatly regret it, because I think the main object of every man who takes upon himself to come forward and read a paper here upon subjects so important and vitally concerning the defences and the war expenditure of this country, should be to get at facts, and if a man is always writing and thinking, and turning up information, and then comes and reads a paper, and people are kind enough to listen to it, it is a process of education for himself and for the Services generally. It is most desirable that the other side should be stated clearly and strongly; and therefore I confess I am disappointed that none out of many distinguished naval Officers present have answered my arguments. I am grateful to General Lowry for saying what he did. He was kind enough to mention some matters connected with the training of Irish recruits in 1871, and I am very glad to acknowledge the fact that I should not have been so successful, under the difficulties we were in at the time, if it had not been for my marine artillery training, and also for the cordial assistance and support of General Lowry, who was then Colonel of the 47th Regiment, and commanding Officer of the troops at Limerick, and also for the co-operation and assistance which his regiment kindly gave me upon all occasions. With regard to remarks made by Major Bridgford, he says that marines are not manufactured on shore. I never said that a marine is, or can be manufactured on shore. What I say here is that he must be trained at sea, not by simply going out for a few days' cruise: what I pointed out was that a mastless ironclad could carry more marines than sparred ships, and by having its complement chiefly composed of marines and marine artillery, and by disembarking them as fast as they become efficient as marines, I think that process would turn out more artillery and infantry soldiers trained to sea service than the old process which he spoke about, and which I think has been evolved out of want of any real naval system in the past. With reference to Captain Dawson's remarks, I am entirely at one with him in what he says, but he rather suggested that a naval Officer individually did not understand the chain of discipline. I maintain that the naval Officer has suffered from the negligence of the country, in not giving the Navy opportunities of a system by which the naval Officer would understand what the chain of responsibility really consists of, and the only way in which the Navy could be worked really as an organized force, is by that very chain of responsibility which it now lacks. With regard to what Admiral Boys was kind enough to say, I am very sorry indeed if I did colour the educational process in any shape or form in favour of the marine artillery. It was not my intention to do so, and he has not pointed out specifically any error in my statement; but perhaps from want of clearness I may have appeared to confuse the matter. It was the primary education of the naval Officer as compared to the marine artillery Officer at the age of twenty, that I referred to. I pointed out that at the age a marine artillery Officer had finished his primary education, so as to become an effective Officer at the cost of the State, the naval Officer had not completed his, and in drawing that parallel, I intended to show the vast waste of national money and national power entailed in educating to a superior extent a body of scientific Officers, making them fit to direct land or sea artillery operations, and to go on board ironclad or other ships to perform naval gunnery duties, and then from the moment they do go on board they have nothing in the world to do. True some Officers have occasionally been put in possession of gunnery responsibility in a ship—many years ago I was, myself—and even now through courtesy, or the particular view of the Captain of a ship, a marine artillery Officer is sometimes called upon to do gunnery duties. For instance, one of the turrets of the "Inflexible" was fought by marine artillery, commanded by a marine artillery Officer at the bombardment of Alexandria, and I believe, most entirely to Captain Fisher's satisfaction. His position in this exercise of duty, for which the country had trained him, was due to Captain Fisher's courtesy; other Captains deny marine artillery Officers such positions, and there are no regulations for their artillery employment. I say that in these days, when it is so difficult to get money for war purposes, you have no business to

waste one penny, and I assert you are wasting thousands in creating marine artillery Officers whom you say you can't or won't employ. Admiral Boys is in favour of abolishing the Marine Artillery, because the Officers and men are too scientific and too highly trained. Well, if you have got such a superabundance of scientific training and artillery knowledge that you cannot really apply it to naval or general purposes, whether on board ships or on shore, to meet the naval wants of our huge sea Empire, I say if we are so teeming with knowledge, and with scientific power, then do away with the superabundance, and do away with the Marine Artillery. On the other hand I confess, that looking to what the war requirements of England would be, to the coast operations and the defence of trading lines, coast covering forces, blockading forces, torpedo duties, defence of mercantile ports at home and abroad, and the whole complication that is sure to arise in war, I think instead of having a superabundance of scientific and trained forces, we, on the contrary, are lamentably deficient, therefore I say that the misuse and waste of the Marine Artillery and Infantry is a great national question. It is not to be put off by praising the marines, and saying they are a splendid force, "a useful body of men," &c. We have no business to be complaining that the Naval Estimates are too small, while there is a force of nearly 3,000 artillerymen with Officers scientifically trained as they are, being wasted, which means waste of money also; therefore I agree distinctly, that if we have got a superabundance of highly trained forces, the Marine Artillery should be abolished; but I most absolutely deny that we have, for sea purposes, even a sufficiency of trained force. Looking at the rapid progress of the science of war on the sea, and the growth of our sea trade, we should be thankful we have a properly organized force of marine artillery, but we should not waste that force as we do, but should use it in the best possible way. Admiral Boys says there is no room or no work to do for marine Officers. I read a paper here some two years ago, on the necessity for naval intelligence for the protection of commerce in time of war, and I am happy to say that since that paper was read, there has been a Naval Intelligence Department formed.¹ In that paper I asked, "Why should marine artillery Officers be employed as professors at the Staff and Military Colleges, instructing military students in military art, while the Admiralty has to rely on the War Office for such topographical information as is necessary for naval operations on the enemy's sea-board?"² I do maintain that if there is no use for marine artillery or infantry Officers on board ships of war, yet there is plenty of scope for the employment of that class of Officer. By all means if you can get the perfect training, and the necessary knowledge in the naval Officer, so much the better; but it is difficult to do so, because he has so many things to learn. With regard to applying the marines, artillery and infantry, to provide the means necessary for fighting merchant steamers when armed, Admiral Boys said seamen ought to be instructed by naval Officers. I am entirely of his way of thinking, in so much that whenever seamen have to be taught as seamen, I think it must be by naval Officers. But I never raised the question of teaching seamen on board merchant ships. What I said was that these merchant ships required a fighting force, and as we all know, the crew of a merchant ship is cut down to as small a number as possible. The competition is so keen that they must chee-sep-are in order to make a profit: the result is that the actual crew of the merchant ship is only just barely sufficient to keep the ship going, and out of that crew you cannot get a sufficient number of seamen to be a fighting force, and when you have to deal practically with arrangements for one of these armed steamers, it is no use your sending an Officer on board to teach the men to fight the guns; because the men

¹ "Naval Intelligence and Protection of Commerce in War." *Vide* "Journal," vol. xxv, No. CXII. See also the remarks of the First Lord of the Admiralty (Lord Northbrook), relative to that paper, at the Annual Meeting of the Royal United Service Institution, 1882.

² I asked that question in 1881. In 1882, when naval operations became necessary at Alexandria, it was completely justified by the dispatch of an Army Staff Officer to the assistance of the Admiral.—J. C. R. C.

have no time, you could not get a gun's crew, you could not get your stokers from the engines, and the men on watch below to come and learn the drill ; you might get saloon servants, &c., but they are not seamen ; therefore, when you talk of arming and manning merchant steamers, you must be prepared to put a ready made fighting force on board. I do not want to take any work out of the naval Officer's hands that the naval Officer can do, or the Navy provides for ; but I do maintain that when you come to arm your merchant fleet, the very first thing will be that you will, unless my plans be adopted, have great difficulty in finding a sufficient number of fighting men disciplined and trained ready to go on board.

Admiral BOYS : The naval reserve would be the first.

Captain COLOMB : Quite so, if you can catch them : but where are you going to get them on short notice ? Supposing you are going to arm 150 ships. You see war coming on, but those ships will go on running as usual to the last minute, and when war does break out you will find half of them abroad. If you have got your force scattered in ones and twos throughout your merchant fleets or bottled up at home, those ships will come home, and perhaps have to go out again, without any fighting force at all ; therefore, to apply the principle of providing a fighting force for the merchant ships of this country as auxiliaries, you cannot base any assumption of efficient organization for that purpose which does not provide for the distribution of the force at all times on foreign stations where the merchant ships are continually calling. That being so, unless you have marines and marine artillery at various stations abroad, you cannot carry out that scheme. If you say it is a seaman's duty, then you must so far modify my sketch as to say that you must keep bodies of seamen on shore during peace at the stated points, if you are to simultaneously arm any proportion of your ships at any time. I have been asked, by Captain Bridge, a question as to what Discipline Act the marines should be placed under when serving on shore abroad, as I propose. My opinion is that they should serve under the Army Act, and that Officers trained for a specific purpose on a certain element are the Officers to command on that element. If you are going to place any body of marines in any position on shore, as I propose, to be used as soldiers, then, if the work is to be done efficiently and well, they must be under the Army Act, for the same reason that when Officers and men are put on board ship they certainly must be under the Naval Act. Captain Bridge also referred to Captain Campbell's lecture. I should like to read what Captain Campbell really did say. It was Captain Fletcher Campbell, R.N., who commanded so gallantly the Naval Brigade in Zululand. He says : "It seems to me not only unjust but inadvisable that an Officer in the Royal Marines when on shore should take command after a naval Officer who may be, and very probably is, very much younger and less experienced." I think it stands to reason that an Officer trained for shore operations is really, as far as possible, the proper Officer to command the landing force.¹ I wish to say, although the garrisons placed at the strategical points and outlying positions should unquestionably maintain their marine discipline while on shore and be under the Army Act, and commanded entirely by their own Officers, the whole force, with regard to its application when away from such positions, must be under the general control of the Admiral. The marine Officer, whoever he may be, in command of the station, would be the immediate and responsible commanding Officer of all these troops when serving on shore. When the Admiral requires a point to be seized, or a force to be moved, or any military work to be done, of course

¹ Were marine forces placed at the headquarters of each naval station, the Admiral would always have available marine Officers of rank and experience to take command in landing operations. Under existing arrangements, the senior marine Officer in a fleet or squadron must always be junior to all Captains and Commanders, even were the regulations referred to by Captain Fletcher Campbell altered, and therefore the extraordinary anomaly of naval Officers without experience of land operations commanding marine Officers who have both knowledge and experience of such duties would not be remedied, even were Captain Fletcher Campbell's views practically embodied in new regulations.—J. C. R. C.

he would give his orders in the same way as the Admiralty and the Horse Guards work together at home. Details should, I think, be left to the marine Officer entirely. I will, in conclusion, thank you, Sir, for having so kindly taken the chair to-day.

The CHAIRMAN : It is my pleasing duty to ask you to direct me to convey the expression of your thanks to Captain Colomb for his most interesting, and, I believe, most valuable paper.

Friday, February 9, 1883.

ADMIRAL SIR ASTLEY COOPER KEY, G.C.B., F.R.S., Lord of the Admiralty, in the Chair.

BATTLE SHIPS—A FORECAST.

By NATHANIEL BARNABY, Esq., C.B., Director of Naval Construction, Admiralty.

The CHAIRMAN: I am sure Mr. Barnaby does not require any introduction from me. You are all aware that in listening to him on the subject of "battle-ships," you are listening to the highest authority in England, I may say in Europe.

Mr. BARNABY: Before I make any remarks on battle ships, which form the subject of this paper, I should like to define the position which I think they occupy in the naval resources of the Empire.

The power of waging war on the seas depends, I consider, upon the following elements stated in their relative order of importance:—

1. The quality and extent of the mercantile marine in ships and men, provided that the national tie in both is real and firm.

2. The quality and strength of the trained *personnel* in the State Navy.

3. The ability to produce or procure rapidly and continuously material of war for the use of the State.

4. The number and efficiency of the regular ships-of-war possessed by the State on the outbreak of war.

Battle ships form a part of the last-named element.

There has been much controversy concerning the distribution of their armour; the size, number, and mode of mounting the guns; their speed, and coal endurance, and other matters.

But these questions all resolve themselves into one of size of ship. Armour, guns, speed, and fuel all demand as much as can be conceded to them; and the limit to each is finally imposed by the size or displacement of the ship. The controversy has taken form and shape in Italy in more imposing proportions than it has in England or France, and it has fastened itself on the question of absolute size.

Signor Brin, the Director of Material, and ex-Minister of Marine in Italy, is responsible for the designs of the largest battle ships she has produced and is now producing. In a very able pamphlet on the question he says, comparing single ships of great power with a group of ships of less power, that the case stands as follows:—

"The slower group cannot overtake the single faster ship, and she can always be mistress of the situation and maintain herself in the front, in the rear, and on the flank of the group at whatever distance she pleases, by changing these positions, by approaching nearer or drawing away from the group in order to attack one of the vessels."

By combining greater defensive "and offensive powers she can employ with greater precautions for herself, and with greater probability of success, the terrible torpedo."

He says further: "There is an old rule in military strategy, which, nevertheless, is always new, since it has never been belied by facts or experience; and it is the rule of concentrating successively, first of all on one point, and then on another, the greatest possible amount of force. Following this rule, we have seen small armies successful against large ones. In order to carry it out rapidity of movement is indispensable. But in what way would it be possible to put this rule more effectually into practice than by accumulating in the smallest space, in one very fast ship, such fighting and such defensive power as to enable her without hesitation to seize on the weak points of the enemy with the probability of success?"

In this paper I neither adopt nor challenge these arguments.

I am content to say here that with increase in speed and size the ship not only increases in mass, signifying greater energy in striking at given speeds, and greater resistance to injury when struck, but it becomes more easy to secure speed and endurance.

And not only so, but England possesses exceptional advantages in forging such weapons, and within the limits imposed by sizes of docks and shoaling of water it is conceivable that she might furnish herself with ships far more powerful than any which have been yet seen.

Diagram.—Battle Ships of European Powers.

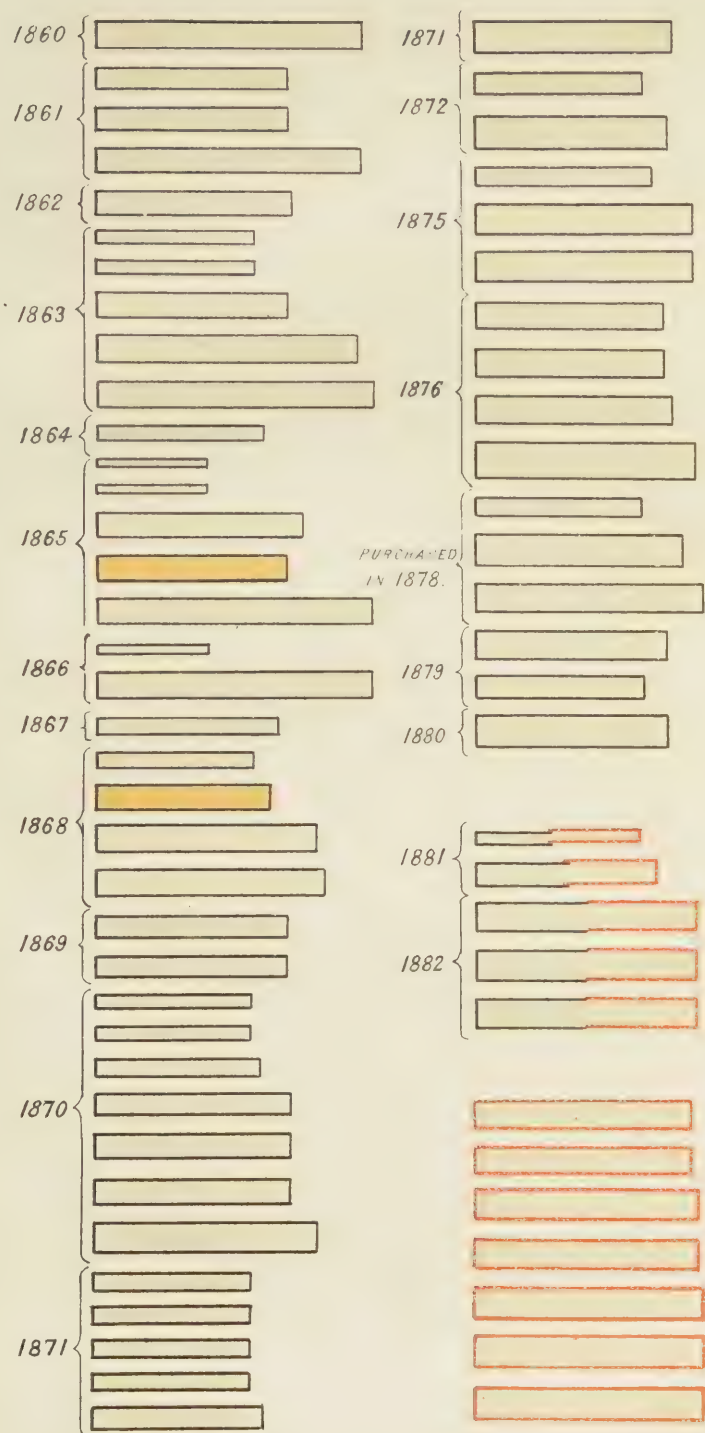
The cost of individual ships must always be an important consideration, and it is especially so with a Power having extended Empire, requiring her to be present in force at the same time at many remote parts of her dominion.

It is a consideration, however, which must not be pressed too far, because the possession of ships which the financial limitation precludes might enable her to close a war rapidly, by blows at the heart of the adversary. In this way war at the remote parts of the Empire might be avoided, or terminated very quickly.

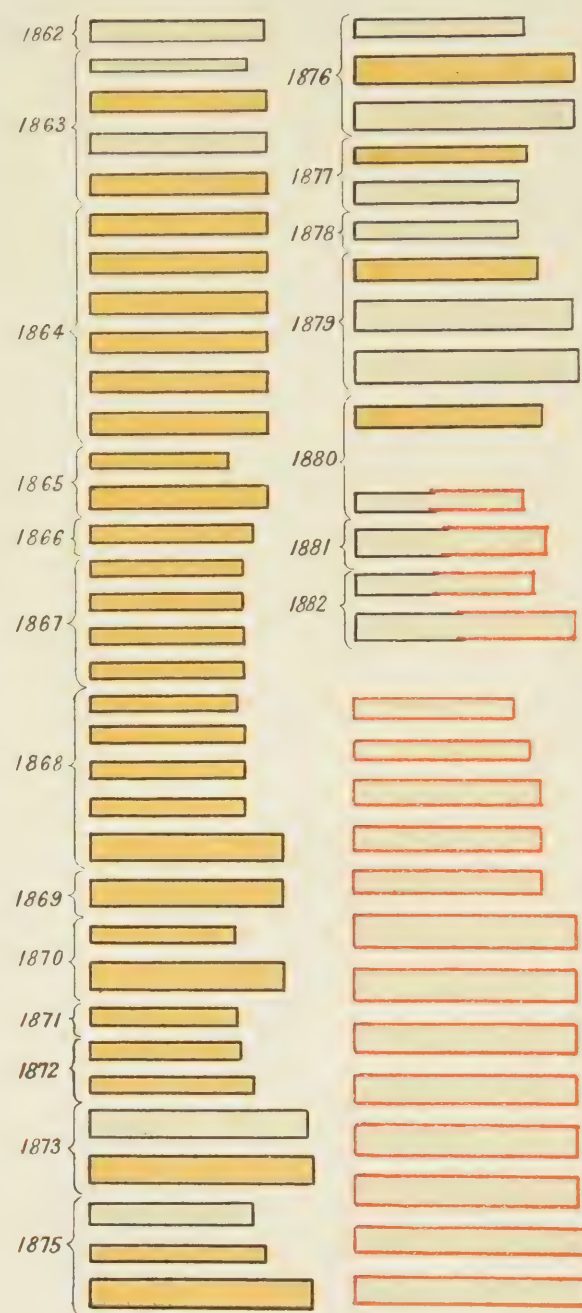
Constantly improving modes and means of attack upon ships by ships, and from the shore, threaten to change the character of the battle ship; and it is uncertainty in this respect which emphasizes the financial limitation. The recent operations at Alexandria show that for certain portions of the work the Navy is called on to perform the ships designed twenty years ago are still efficient. But the absence of torpedo-boats, and the neglect of torpedo defence on the part of the Egyptians, count for so much in this question, that the argument derived from success in that operation in favour of the earlier and also of modern types of battle ships is not worth much.

BATTLE SHIPS.

ENGLAND.



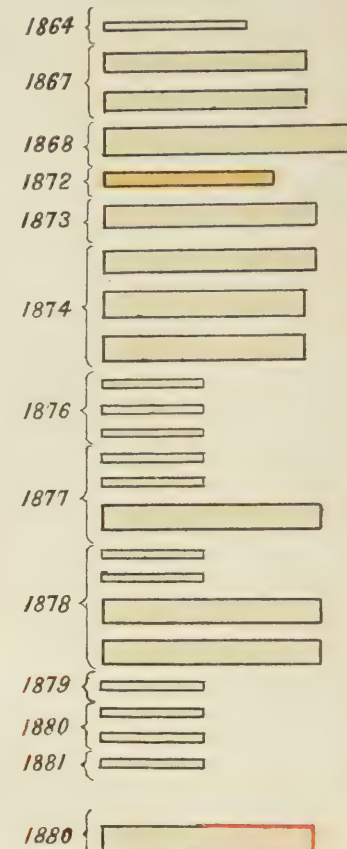
FRANCE.



ITALY.



GERMANY.



REFERENCES.

- Ships now available.
- Ships launched and completing.
- Ships not launched.

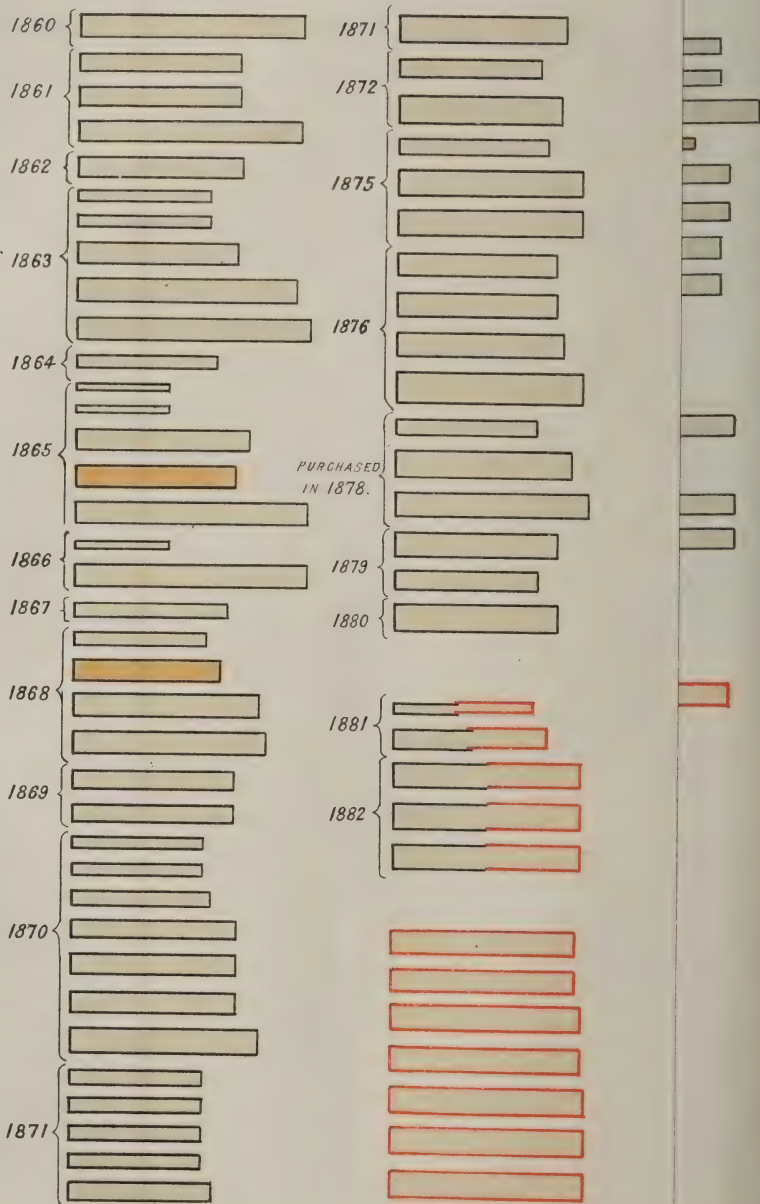
Blue colour—Iron and steel ships.

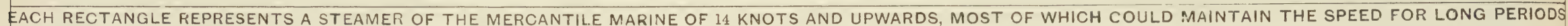
Brown colour—Ships built of wood.

Dates are those of launching.

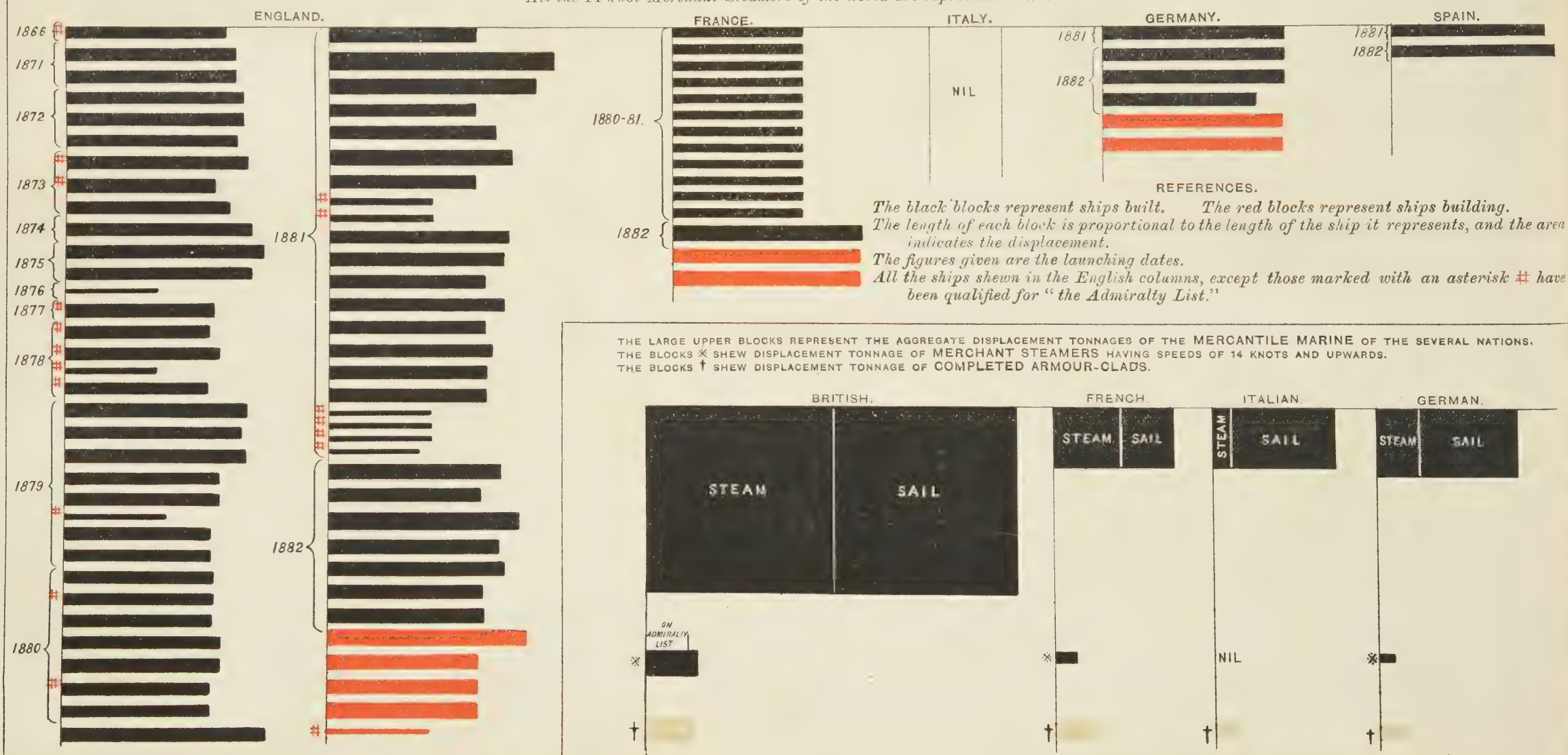
The length of each block is proportional to the length, and the area to the displacement of the ship it represents.

Y.



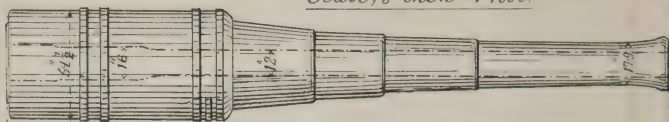


All the 14 knot Merchant Steamers of the world are represented here.



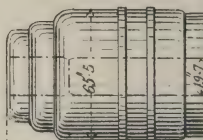
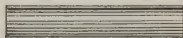
12 INCH, 43 TON, B.L. GUN.

Scale, $\frac{1}{8}$ inch = 1 foot.



Total length 27' 4 1/2".

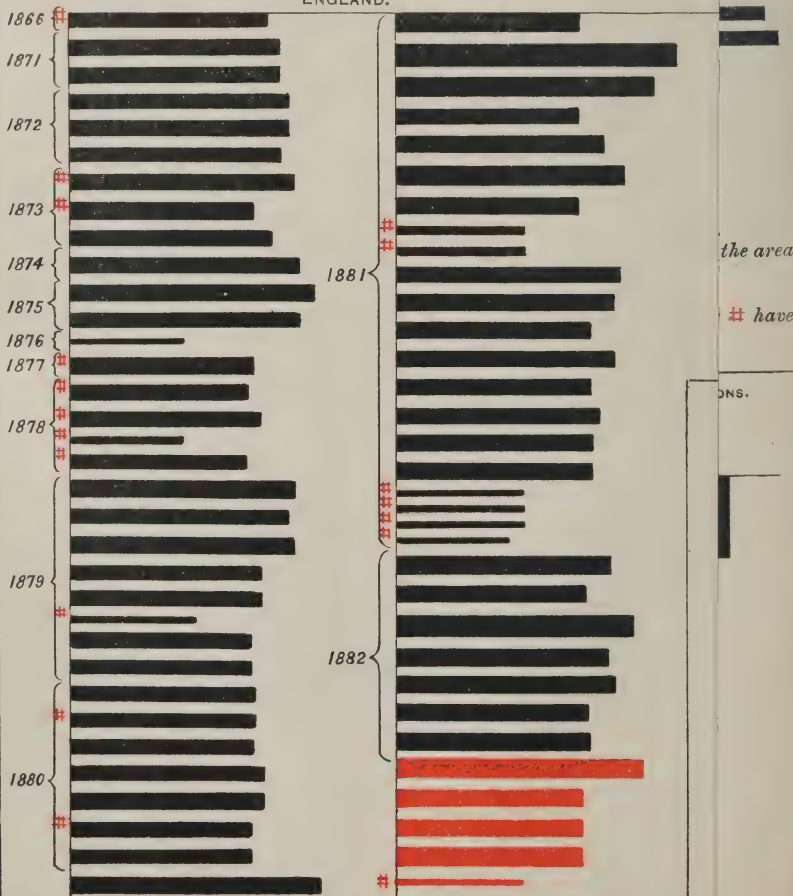
Approximate Maximum Powder Charge.



EACH RECTANGLE REPRESENTS A STEAMER OF THE MERCANTILE PERIODS

All the 1

ENGLAND.



We may perhaps get some clearer notion as to what the battle ship should be for England, if we consider more closely what it will be required to do.

1. It must be capable of striking very destructive blows where the enemy is fortified, either in his ships on the open waters, or in his forts upon the sea-coast.

2. The machinery for striking these blows must be capable of being kept in position in the face of an enemy in the open sea, or off a port.

3. The use of torpedo-boats of high speed and in great numbers tends to the gradual extinction of the power of attacking or blockading the sea forts of an enemy by means of large ships, because of their great cost and the risk of fatal blows from the torpedo.

4. The advantage of being able to inflict damage upon the shipping which may be under the protection of land fortifications, or to close the port, will also be so great that the mode of attack must modify itself to suit the change in conditions. There can be no doubt, I think, that gun-vessels with numerous long-range shell guns, and costing not more than one-fourth of the modern battle ship, will displace the battle ship *for this service*, notwithstanding the disadvantages of the smaller ships in unsteadiness of platform and inferior seaworthiness.¹

The battle ship of large size is not only likely to become obsolete for the attack and blockade of ports, but also for another important service, viz., harassing the commerce of an enemy.

This results from the great speed and coal endurance of the large ocean steamers.² Armed ships of the same character as those to be captured will probably be the favourite weapons for inflicting damage upon commerce.

These ships are now nearly twice as long as the ship-of-war of the same weight, and they can, therefore, much more easily secure and maintain a high rate of speed at sea.

I consider it would be most impolitic to build regular ships-of-war on similar principles for the purpose of pursuing and engaging them. The 17 knots ocean speed of to-day may be exceeded by commercial rivalries in the course of a very few years. It is desirable that this should be so; and instead of attempting to produce fleets of regular ships-of-war as a consequence of the existence of these fast possible war cruizers, we should endeavour to modify them and incorporate them in our national defences.

That they need very considerable modification to make them reasonably secure against the assaults of an enemy by artillery or ram is obvious enough.

But too much importance must not be attached to cases of rapid foundering on collision. Ships having many "watertight bulkheads" and passing the survey of Lloyd's and of the Board of Trade are often

¹ It would follow from this that ports which can be defended by torpedo-boats will not require for their fixed defences very heavy guns or very thick armour.

² Diagrams of Mercantile Marine, and of the fast ships included therein.

so circumstanced as to bulkheads that they may as well be without them so far as they affect the question of foundering when they are struck by the bow of another ship.

We may well look for great improvement in this respect by very simple precautions not now enforced or adopted.¹

The Secretary of the Navy of the United States in his Annual Report to Congress, dated November 29th, 1882, dwells at great length on the position and prospects of the Mercantile Marine from the point of view of the Naval Administrator.

He says: "As the merchant marine is dependent at critical periods upon the Navy, so, on the other hand, the Navy, no matter how strong it may be, must, in emergencies, avail itself of the resources of the merchant marine."

At the outbreak of the rebellion the State Navy had nominally a tonnage of 105,000 tons. To increase it they had to buy 216,000 tons, which they found very "ill-suited for war purposes, but none the less indispensable." They had also to make additions to the Officers and men of the war Navy by drawing from the Mercantile Marine 7,500 Officers and over 40,000 seamen. He shows that between 1860 and 1865 the percentage of the foreign carrying trade of the United States performed by American vessels dropped from $66\frac{1}{2}$ to $27\frac{3}{4}$, and since then has fallen steadily, so that it is now only $15\frac{1}{2}$ per cent. He demands for the shipping trade the removal of impositions which he thinks unfair, the extension of protective measures to the neglected industry, and the reform of administration. He apparently does not like to propose the abolition of the protective measures which make shipbuilding materials so dear.²

Referring to the French Bounty System of January, 1881, and the recommendation of a similar system by Prince Bismarck to the German Parliament in 1881, he recommends a system of postal subsidies, involving the condition that such ships should be built according to Governmental requirements, and be subject to be taken for national use in time of war. He gives us credit for having such conditions in our postal contracts, but in that he is mistaken. Our postal subsidies have reference exclusively to postal requirements.

¹ Facts as to losses of ocean steamers said to be divided into watertight compartments:—

The number of British ocean-going steamships of an average ocean speed of 11 knots and upwards lost at sea since December, 1876, has been thirty-six, or at the rate of six per annum.

Of these, thirty had been offered for the Admiralty List, but only four were found to be reasonably divided into compartments, and accepted for the List. The total displacement tonnage of the thirty-six ships was 160,000 tons, and of the four ships accepted 16,000 tons.

Of the thirty-two ships not on the List, ten are known to have been lost by collision, and six by springing a leak. Four of them were lost from unknown causes.

Of the four ships lost which had been accepted for the List, all were lost by going ashore. They were the "Tasmanian," in 1878; the "Illimauni," in 1879; the "Arklow," in 1880; and the "Wicklow," in 1882.

² The action of the American House of Representatives in proposing a "Free Ship" Clause in the Shipping Relief Bill had not been taken when this was written.

One need hardly say, for it is obvious, that every trading ship possessed by a State is an advantage to the whole world, because it is an additional guarantee given for peace.

Operations on or in the neighbourhood of an enemy's ports, and attacks upon his commerce, are the two most important fields of maritime warfare. Fleet actions have hitherto grown out of them; and it is reasonable to expect that they will do so in future, and that the ships best adapted for these two fields of warfare will always be found in contending fleets.

The presence among the lighter ships of some ships with steady platforms, exceptionally heavy guns, and those guns defended by armour, would of course be a great advantage; and this may possibly become the sole function of what we now call the battle ship.

For this purpose neither exceptionally high speed nor great handiness would be regarded as so important as they now are held to be. They would need to have the average speed of the smaller ships of the squadron, and no more. What they would especially require would be heavier guns than can be mounted and worked at sea in the small vessels, steady platforms for working them, and good protection.

The guns that can be mounted and worked at sea with advantage in vessels of very moderate size may be of considerable power.

Their weight and power will be limited by the following considerations:—

1. As they are unprotected by armour against even the lightest shell, and as the ship carrying them would hardly be suitable for the service at all if less than about 2,000 tons displacement, there must be at least two such guns in each ship. In other words, the ship will be too large and costly to justify dependence upon a single gun so greatly exposed to fatal injury in itself, its mountings, and its communications with its magazines.

2. The vulnerability of the ship itself will keep down its size to a minimum; and it will almost certainly take the shape of a vessel of 2,000 to 3,500 tons, with a protecting deck, high speed, and two guns mounted in the middle line, one firing ahead and the other astern. It will therefore be necessary to place the guns as far out of the centre of the ship as possible consistently with seaworthiness, inasmuch as the spar deck spaces before and abaft them must be of the nature of a glacis, and be uninhabitable.

3. With this limited number of guns it will be desirable not to have a very slow fire from each gun. The introduction of machinery for the purpose of quickening the operation would be perilous, seeing that it cannot be protected. These considerations will tend to keep down the size of the guns, and they will probably not exceed a weight of 25 to 30 tons each. But it may be anticipated that guns of this weight will be found in this class of small and fast protected seagoing ships.

This justifies the expectation that the protected battle ship proper will require guns of larger size and power than 30 tons, so long as such larger guns are found to have advantages.

These guns may possibly have large calibre. Excepting the guns

of the "Inflexible," the largest gun yet constructed for the British Navy has 12 inches bore, and a weight of 43 tons. The ships recently commenced will have larger guns, probably 63 tons in weight, or heavier.

Diagrams of 100 ton B.L. "Italia."

" 43 " B.L. "Collingwood."¹
 " 80 " M.L. "Inflexible."

Experiments against steel and steel-faced armour have shown that we have at present no material out of which to forge or cast a projectile which will act at the same time efficiently as a punch and a shell. And even if we give up the attempt to make the shell, we have not yet found a way to punch a hole through the plates as we could through iron. We have to break a way through, and small diameter of projectile and small mass, with high velocity, are not favourable to this.

Large diameter gives mass, strength of form in the projectile, and favours the conversion of the projectile into a destructive mine for use against the unarmoured parts of the ships attacked, and against the walls of barbettes.

England has been successful in producing guns of 16 inches and 17 inches bore. And she has also done what no other nation has yet effected; viz., she has mounted such guns in a manner which brings them under perfect control by very simple mechanism.

The skill of the firm of Sir William Armstrong and Co., which has produced this mounting from the designs of Mr. George Rendel, is only an example of the mechanical power in design and execution which may be trusted to place in English battle ships weapons of power which other people cannot exceed. I have never pleaded for large and costly ships, but I have always agreed with those who hold that England should put into the hands of her seamen the most powerful guns which can be made and worked. In this way she ought to make her manufacturing skill tell in her favour. One reason why some other Powers do not adopt large guns may be that their own engineers find difficulties in mounting and working them.

As to armour, I ventured to say in 1876 that I thought the thickness of armour in the "Inflexible" was not likely to be exceeded. I am still of that opinion. I do not believe that increasing the calibre and weight of the gun will tend to thicken armour.

The result will, I believe, be that armour will finally nearly or quite disappear as side plating for the hull of the ship, and that where it must continue to be used for the protection of the gun and its mounting it will improve in quality, so as to be impenetrable to shell, however made. The principal projectile must be shell, and we shall probably find our-

	Tons.		Powder, lbs.		Projectile, lbs.		Energy, foot tons.
1	43	.....	400	.....	714	.....	20 000
	80	.....	450	.....	1,700	.....	30,000
	100	.....	770	.....	2,000	.....	46,0000

The 100-ton B.L. gun is 39 feet long. The projected 63-ton Woolwich gun is already considerably longer, and is probably growing.

selves with steel defences of excellent quality, but of very limited extent, over our gun mountings; and the smallness of their size and their impenetrability to shell will practically leave them unassailed, while the upper works of the ship, above the shot-proof deck or belt, are attacked by shell.

Reluctance to introduce large guns would, I believe, only delay this process of change.

I have not touched upon those other reasons for advocating the association of small and fast protected but unarmoured vessels with battle ships which arise out of a consideration of the exigencies of the purely naval fight upon the high seas.

A thoughtful paper was read on that subject at this Institution by Captain Harris last year, and the Chairman then referred to the great debate on the question in the Institution of Naval Architects in 1876, and to a subsequent paper of mine of 1880.

What I have tried to do in this paper is to strengthen the argument in that direction, by considering more particularly how two well defined naval operations, the attack upon ports and the protection of commerce, have in their changed conditions affected the question of the character of the battle ship.

The questions raised in this paper which seem to be debateable are,—

1. Should England build ships greatly exceeding in speed, coal endurance, guns, and armour existing ships of the first class, regardless of size and consequent cost?

2. Will not the enemy's ports require to be attacked and blockaded, notwithstanding the torpedo? and if so, what description of ship will be suited for this attack?

3. Ought regular ships-of-war to be built of sufficient power and speed to capture ships like the "Servia" and "Alaska" and their larger and faster successors? or should we not rather look to the services of such ships for the work, endeavouring to fit them for it?

4. When the powers of the ram and the torpedo come to be tested in actual warfare between two Great Powers, what part may we expect to be assigned to the fast gun and torpedo ship with protecting deck, and the merchant auxiliary, as a result of these contests?

5. Ought the battle ship of the first class to carry guns of the largest calibre which can be made and worked? or should we be content to allow the gun to progress slowly with the advance of the armour?

I have wished in this paper to guard myself against the advocacy of a particular policy with regard to any of these questions. It is my duty to observe tendencies carefully, and as no discussion on such subjects can be profitable which does not take the elements tending to change of conditions into account, I have submitted them to you. When travelling along a badly defined road in an unknown and difficult country, we may avoid errors and delays by getting on high ground, overlooking the minor features of the road along which we are passing.

Vice-Admiral BORS: I should like to make a few remarks upon this paper,

although I must confess that I do so with some diffidence, for he must be a bold man who ventures to attack Mr. Barnaby on such a subject as he has taken up to-day. The first question I would ask is, what is the real meaning of the term "battle ship?" because I do not see that it is laid down in any classification of Her Majesty's ships. We all surmise what it practically means: it means a ship to take the place of what used to be the old line-of-battle ship; but still at present we do not know where the battle ship ends, and where the frigate or whatever comes next to her begins; we have no definition of it, if it could be defined, we should be a little clearer. Mr. Barnaby begins by saying, "The power of waging war on the seas depends, I consider, upon the following elements stated in their relative order of importance." Of course, this means the successful waging of war. No doubt these are all elements, but in my view of the case he has not exactly placed them in their relative order of importance. I should be very much inclined to "reverse the line from van to rear" altogether. I think the first element is the number of efficient regular ships of war possessed by the State on the outbreak of war. The early success of a war will probably be the most important during the whole war, and it is quite possible that ships and fleets may be blocked up in harbours by the first blow that can be delivered. For that reason I place that element first. Next to that I place "the quality and strength of the trained *personnel* in the State Navy." "The quality and extent of the Mercantile Marine in ships and men, provided that the national tie is both real and firm," is a very important element. There is another that I should like to add, namely, the proficiency of the Officers and men to fight these ships, and that is a most important element in war that must be provided for in peace time. Lastly, comes the aptitude of the nation for seafaring pursuits from which we have to provide the reserves. On the question of Signor Brin's pamphlet, I am generally in accord with what he says. I think he has given us a fair description of the right qualifications of first-class battle ships. I consider Italy to have been perfectly right in what she has done. She has got rid of her old obsolete ships, and expended all her money in procuring the largest and most powerful ships in the world. Certainly, she is peculiarly circumstanced. She has her own sea-coast only to protect; her ships will not be required to go far from home, and, on one point, she has a great advantage over us, because the coal endurance of the ships is not so much a necessity for her as it is for us. The diagrams are most clear and instructive. I have learned immensely from them, and I must confess I have often before this learned much from Mr. Barnaby. The next point is the cost of individual ships as an important consideration. It is made an important consideration with us, but in my view of the case it ought not to be made an important consideration at all. Consider what we have at stake, our food supply—the very existence of our homes—depends upon the efficiency of our Navy, and I am sure the country, and the British taxpayer, if he only knew and would only consider the question, would not hesitate to make great sacrifice to provide for every necessary expenditure to meet its requirements. I may here refer to a letter published the other day by Sir Edward Reed, in which he puts the case very fairly as to the necessity of spending more money upon the Navy. I am not a politician, but I think every Government of late years has been hampered by the necessity of reducing Naval Estimates; and, consequently, we have not got that efficiency either in quality or number in our ships that we might have had, had more money been devoted to the Navy. Sir Edward Reed alluded to half pay and pensions; that has little bearing upon this question of battle ships, but I think the country would not even object to the money spent in that way, for what is to become of us when we become old fellows? Are we all supposed to go into the workhouse? We must have something to live upon. Mr. Barnaby in referring to the use of torpedoes says: "The use of torpedo-boats of high speed and in great numbers tends to the gradual extinction of the power of attacking or blockading the seaports of an enemy by means of large ships, because of their great cost and the risk of fatal blows from the torpedo." I do not quite see how this paragraph is intended to apply in connection with battle ships, because if we are not to attack forts owing to risk, surely we had better not fight at all. No fighting can be undertaken without risk, and I think in the matter of torpedoes there is much uncertainty. No doubt the effect of them is most formidable if they succeed, but there are so

many "ifs" concerned with them, that the mere fact of torpedo-boats existing must not be allowed to drive our blockading fleet away. As to the risk run in the case of large ships, there is another view to be taken of the question; the larger the ship the better she is able to withstand the damage that might be inflicted by a torpedo, and what might sink a small ship may not materially affect a large one. I think what the employment of torpedo-vessels should tend to, is to develop the defence against those torpedo-boats which I cannot think has received sufficient attention. There are more ways than have yet been tried of developing the question of defence against them. Next comes "The advantage of being able to inflict damage upon the shipping which may be under the protection of land fortifications, or to close the port, will also be so great that the mode of attack must modify itself to suit the change in conditions. There can be no doubt, I think, that the gun-vessels with numerous long-range shell guns, and costing not more than one-fourth of the modern battle ship, will displace the battle ship for this service." The question with regard to this must depend a great deal upon the ships to be protected, and the protecting forts themselves. We will suppose that a fleet is blockaded in an enemy's ports, or in one of our own ports; surely there are different descriptions of vessels required for the blockading of a port that is holding a fleet, and a port that contains no fleet, only simple merchant vessels. Supposing the "Inflexible" was inside a port attempted to be blockaded, I am sure her late gallant Captain, who I am glad to see present, would not allow himself to be blockaded by any unprotected vessel however large her guns might be. I do not think the "Inflexible" would mind any amount of the vessels hereinafter described in this paper. Mr. Barnaby says the guns that can be mounted and worked at sea with advantage in vessels of very moderate size may be of considerable power, and he afterwards describes a ship of from 2,000 to 3,500 tons with a gun of from 25 to 30 tons in her extremes. I would ask what is this ship really intended for? If she is built for the purpose of engaging large ironclads, I dispute the advantage which the ship would have at all. If she is intended for the purpose of attacking unarmoured ships, in my opinion a broadside of lighter guns would be far more efficient. Mr. Barnaby says "this justifies the expectation that the protected battle ship proper will require guns of larger size and power than 30 tons, so long as such larger guns are found to have advantages." Perhaps he will explain this a little further; I do not understand how he arrives at this deduction—that because a small vessel can carry a 30-ton gun, that a battle ship requires larger guns. With regard to the projectile, Mr. Barnaby, I think, asserts that it is necessary that we should have shell, and that we have not arrived at any material that will drive a shell through armour. This is quite right as far as it goes; but is it necessary that we should have shell? I do not think that we can get shell to do what he mentions. Is not the effect of a solid projectile, or a partially solid projectile, passing through armour and scattering the *débris* and splinters in all directions very effective? The paper then says, "The questions raised in this paper which seem to be debateable are—first, should England build ships greatly exceeding in speed, coal endurance, guns, and armour existing ships of the first class, regardless of size and consequent cost?" In my opinion she should—not greatly exceeding, but exceeding the power of any other ship afloat. I do not think we should initiate the policy of building extraordinarily large ships, but if our probable enemies possess ships of very great power, I think it is our duty to build ships that can excel them in all respects. It would not be fair to our Officers and men to put them in ships inferior in any single point to what our enemies might have, and expect them to do what their forefathers did, and hold England's place in the world which they gained for her. The second question is, "Will not the enemy's ports require to be attacked and blockaded, notwithstanding the torpedo?" and if so, what description of ship will be suited for this attack?" This must depend entirely upon circumstances. We must be prepared for what is inside, and one description of ship will not suffice for all duties of blockading. If we attempt to bring these duties into the scope of one ship, we shall simply have a compromise which will answer no purpose properly. Then, with reference to the third question, "Ought regular ships of war to be built of sufficient power and speed to capture ships like the 'Servia' and 'Alaska,' and their larger and faster successors? or should we not rather look to the services of such ships for

the work, endeavouring to fit them for it?" In my opinion we should build some. There are not many "Alaskas" and "Servias," as we see by the diagrams before us. To protect themselves I think it is necessary for our merchant ships to be armed. For the attack of an enemy's merchant navy and to destroy her commerce, I think we must have a certain number of very fast regular war-ships equal to any in speed, and possibly in coal endurance. Mr. Barnaby thinks the "Alaska" and those very fast vessels will be extended, but I am not quite so sure of that. Some of those ships, I understand, are not profitable. With reference to the "Alaska" herself, I have heard it said that so much of her space is devoted to engines and coal stowage, that there is not sufficient room for cargo to make her a profitable investment, therefore I do not think the extension of this class ship is so certain. I will not say anything as to the fourth question, it is too extensive to be discussed now, but pass on to the fifth, viz.:—"Ought the battle ship of the first class to carry guns of the largest calibre which can be made and worked, or should we be content to allow the gun to progress slowly with the advance of the armour?" My view is that the battle ship must carry guns somewhat exceeding the power of any of the enemy's ships, not the largest that can be made, that is probably unlimited. We can do it; we can mount the guns, and can work them, and I think it is a great satisfaction to know that we have such an establishment in the north as Elswick, another arsenal, and, I understand, what is to be another dockyard, where we can have honourable rivalry in gun-making and ship-building. I do not think Mr. Barnaby will object to any honourable rivalry in such a concern as that, and all I can say is that I wish it every success.

Admiral RYDER: Mr. Barnaby's meaning is no doubt very clear to himself, but there seems to be an opening for no little confusion in the minds of his hearers and readers, as to the distinction which he indicates, but does not explain, between a *protected* ship and an *armoured* ship. He uses the words "protected by armour," and then he says "a ship is not protected," and again, "she is protected." I think there is no little confusion running through the paper on this point. Mr. Barnaby might clear it up by putting in this note, viz.: "The expression 'armour' is confined to *side* armour, and that by a 'protected vessel' he means a vessel without side armour, but with a plated deck." At present there is no little ambiguity, I think, and other readers and hearers of the paper beside myself have noticed it. Mr. Barnaby proceeds to say: "The result will, I believe, be that the *armour will finally nearly or quite disappear as side plating for the hull of the ship, and that where it must continue to be used for the protection of the gun and its mounting, it will improve in quality, so as to be impenetrable to shell, however made.*" I think that is a very important statement. Some years ago I had the honour to be on the Committee of Designs, when there was a small minority, Admiral Sir George Elliot and I, that strongly advocated this view, but at the time it was not received with any favour, either by the authorities or by our brother Officers. I am glad to learn that so distinguished a judge, in such a matter, as Mr. Barnaby has been converted; I do not know what his opinion was then. Whether *we* converted him then, or whether he has been converted lately does not signify, but we claim him as a most distinguished convert to our view. We hope the authorities, who undoubtedly consider as of the greatest weight all that Mr. Barnaby says, will really consider this question very attentively. If Mr. Barnaby believes, and has no hesitation in stating, that we should proceed in future in this direction, viz., *armouring the guns, the ammunition uptakes, and the deck below the water to any thickness that can be safely carried, and in getting rid of all side armour, beyond what may be sufficient to resist the projectiles of machine-guns, surely the experiments asked for unanimously by the Committee on Designs many years ago, and again now by Mr. Barnaby, should be carried out.* I am very glad to have another opportunity of recalling my brother Officers' attention to this important subject, viz., of *replacing side armour* in the most powerful battle ships, *by a plate-protected submerged deck*, because it is a question which has been very much lost sight of in that class of ship. As the subject is only alluded to in one short, but most important, sentence in Mr. Barnaby's paper, it might have been overlooked unless I had attempted to give emphasis to it by the above remarks.

Captain P. H. COLOMB, R.N.: This is a paper which requires, I think, from us

all, the very gravest consideration, not only from the subject-matter of the paper itself, but from the position that Mr. Barnaby holds, as practically at the head of the naval architects of the world; and because we may be perfectly sure that even a hint which he appears to drop in a particular direction will be taken up by the public and the press of this country, as pointing out the direction which ought to be followed. Therefore I think that speakers should devote their attention on this occasion to statements in which they disagree, rather than in uttering agreements which would occupy time, and which would be no flattery to a gentleman in Mr. Barnaby's position. I very cordially endorse the last sentence in the paper. We should certainly get on high ground, and the only caution I should give would be that we must take care that the high ground we get on is solid ground, not made ground; because made ground may slip away from us. On this account I have great fear of these large and vague generalities. If I were to put my finger upon the great error of the age, I should say that it was the assumption of a great generality—the establishment of a piece of made ground—without having taken sufficient precautions about seeing that the basis on which we stood was solid. I am quite sure that on the question before us to-day more precision is necessary, and I am also sure that more precision is possible. I will give one or two instances where I think that precision is wanting. The lecturer, quoting Signor Brin, says—"The slower group cannot overtake the single faster ship." That is a question of relative strength. If the group is stronger, the faster ship flies: if the faster ship is stronger, she will not want to use her speed. There may be a faster ship in the slower group, which is quite competent to bring on action if desired." Again—"The faster ship can always be mistress of the situation, and maintain herself in the front, in the rear, and on the flank of group, at whatever distance she pleases." Here we have very confused notions of the fighting value of speed. What is the fighting value of speed? First, to bring an unwilling foe to action: secondly, being weaker, to allow of your escape: third, to choose your range, but only on the condition that you fight a stern battle—you cannot choose your range on any other condition: fourthly, to ram the enemy from a safe position abaft his beam; but then, again, provided that the enemy's manœuvring power is not relatively as superior to yours as your speed is to his. Speed by itself will win no battle. A shorter, or a longer range, is not, in itself, an advantage between equal ships. I will take a third instance of where, I think, the generalization has been improper. Signor Brin says the large ship, by combining greater defensive "and offensive powers, can employ with greater precautions for herself, and with greater probability of success, the terrible torpedo." But is not this assuming all the questions at issue? A large ship means relatively bad manœuvring powers, a relatively larger target for the torpedo to hit, and a heavier loss if she is struck. Is there any ship, large or small, in existence, which is capable of standing with impunity the fair blow of a Whitehead? I do not think that we can usefully speak in such general terms: I think we must ascertain or assume relative values for the different weapons, and that we must build ships to employ each to the best advantage. Recurring now to the paper itself, I must agree with Admiral Boys in demurring very strongly to the term "battle ship," as being too vague, and apt to lead our minds away from precise definition. I ventured, some years ago, to propose that the term "line-of-battle" ship should be superseded by the term "fleet ship." The line-of-battle ship was meant, built, and armed to fight in a particular formation—the line of battle. We do not now know what the proper formation is, but we do know that ships must still fight in fleets; and I think we ought to use that term—fleet ship—as drawing our minds at once to the sort of ship we mean to talk about. Following Admiral Boys, and I suppose I shall have all naval Officers with me, I very much disagree with the classification, at the beginning of the paper, as to the power of waging naval war. I look upon the Mercantile Marine as a naval weakness, not as a strength. I thought so before I came into this theatre: since I have seen this diagram my impressions are very much strengthened. I see these two enormous black squares under the word "England," and I see a little blue square under the word "France," and I think to myself that little blue square is the master of anything within those two black squares, and I am assured that a Mercantile Marine, which is defenceless, is a weakness, and not a strength. In the

paper itself this is very distinctly shown in the case of America, where the only heavy blows that the South struck the North were in sweeping her commerce off the sea—which the North has never yet recovered. True, that the Mercantile Marine may be a strength if you duly incorporate it into fighting material, and keep it so; but it is not a strength in itself. I should put, certainly, as Admiral Boys does, the number and efficiency of the ships-of-war first of all: I should put the *personnel* next: the ability to produce war material third: and I should, undoubtedly, put the strength of the Mercantile Marine last. Those words recall to my mind a very extraordinary sentence published in a morning paper the other day, with reference to Sir Edward Reed's letter, where it was pointed out that we really need not trouble our heads about building ships, because we have plenty of iron and plenty of coal—as if iron and coal, in themselves, would fight our battles for us! We now come, I think, to some of the evils of generalizing in this way, for we find Mr. Barnaby speaking of “harassing the commerce of an enemy” and he puts it as if that was a thing that we were to prepare ourselves for. I think that is a very proper sentence to put in the mouth of a Russian, a Frenchman, a German, or an American, who is talking in his own theatre on a subject of this kind; but looking at these diagrams I really do not see what commerce we have to harass: the harassing, as far as I can make out, would be entirely of our trade. And then we have to recollect that while America suffered a heavy blow, from which she has not recovered, by the loss of her Mercantile Marine, it would be simply death to us to lose ours, or to have our commerce interrupted even for a short time. We are suffering from the evils of a long naval peace: we do not realize what it is to be navally on the defensive, and so we find the lecturer putting side by side two duties of a naval force, fights in the open sea and attacks on ports, and drawing no distinction between their relative importance. Then he goes on to say: “Operations on or in the neighbourhood of an enemy's ports, and attacks upon his commerce, are the two most important fields of maritime warfare. Fleet actions have hitherto grown out of them; and it is reasonable to expect that they will do so in future, and that the ships best adapted for these two fields of warfare will always be found in contending fleets.” I suppose the lecturer assumes that this is true so far as *our* attack goes. It is perfectly true in the letter, but it is perfectly untrue in the spirit, because *we* have always been the enemy, and it is attacks on *our* coast, and ports, and commerce, which have hitherto brought about the naval action. Take Admiral Byng's action in 1756; what caused that? It was brought about by an attempted attack of the French fleet on our island of Minorca. What was Hawke's action in 1759? It was brought about to stop the invasion of the country. What was Rodney's action in 1782? The French were on their way to attack Jamaica. Lord Howe's action in 1794 might be counted on either side, because it was partly brought about by an attempt on the French commerce, but quite as much by the desire to protect our own convoy, which we knew to be threatened by the French fleet. What was Camperdown? It was an action to prevent the junction of the Dutch fleet with the Brest fleet coming to the invasion of England. The action of the Nile was brought about by an attack on the territory of an ally. Calder's action was to prevent a junction between the two branches of the French fleet, also planning invasion. Take the earlier Dutch wars: what were they? The two fleets, the English and Dutch, went into the North Sea, and fought it out for the command of the sea, and the only attack made on shores at all was made by the Dutch on *our own coast*. From the very first of our great naval battles down to the last, from the Armada to Trafalgar, it has been one unceasing rule that we have fought at sea to defend our own coast, and our own commerce, and not to attack those of the enemy. In formulating a naval policy we should not forsake the sure ground of history and experience, for the conditions and form of naval wars are only intensified, not altered. Our Navy, if we come to fight with a naval Power, or a combination of naval Powers, must fight a defensive war, and its only business will be to keep the highways of the sea clear. Until this is secured, nothing else should be thought of. Therefore it is that I fear this growing reliance on our merchant ships. No doubt they can harass an enemy's commerce, but can they protect our own? A fast merchant ship can run away from the heavier and slower man-of-war. The running away will not protect the

unarmed ship which cannot run away. I agree with Mr. Barnaby that the fighting fleet ship does not want exceptionally high speed or great handiness; I do not think these are so necessary for the fleet ship as staying power and great offensive and defensive power. But then fleets must have eyes, ears, and stings, of some speed; you must be ready in your fleet to provoke an unwilling foe to action. Mr. Barnaby tells us that the single gun cannot satisfactorily be mounted in a single ship, that you must have two, and he puts his tonnage from 2,000 to 3,500, and says because you must have that tonnage therefore you must have at least two guns. So far as any experiment in that way goes, it seems to show that very much smaller ships may carry single guns, even to be made fairly seagoing ships. The boats built for the Chinese Government carrying the 35-ton gun were only 440 tons; they had 10-knot speed, for six days: only costing 36,000*l*. The last pair were certainly larger; their displacement was 1,350 tons, but then they carried two 26-ton guns, and they had 16-knot speed. No doubt they were not what we call quite seagoing ships, but they seem to show that you may put a single gun in the centre of the ship of comparatively small size. Again, such ships as these, the fleet ships, must protect themselves by numerous guns; they need not be heavy, but they must be fought under thick plating. The heavy plated ship with few guns and low speed is only a prey to the faster, and lighter, and cheaper torpedo-ship. The fleet ship must have many guns to defend herself; first, against floating gun-carriages; secondly, against the small ones; and thirdly, against the torpedo-vessels; it must have moderate armour—which I always lay stress upon—moderate armour to protect the ship and men against light gun fire. The smallness of the target, as Mr. Barnaby points out, is really an efficient protection against slow fire from heavy guns. I think one of the first things we have to do is to seek out the best formation in which a fleet can fight, and we ought to build and arm our fleet ships with a view to this formation. As to the association of small vessels with fleets for fighting purposes, I must see a distinct use for them, before I accept Mr. Barnaby's dictum; eyes, ears, and stings they may certainly be, but as I understand Mr. Barnaby, he expects them to take their place in what is practically the line of battle, that is to say, they are to join in a naval action on an equality with the fleet ship, and this cannot yet be assumed. Then we come to the five questions at the end. In the first of these we are asked—"Should England build ships exceeding in character those large ships, the 'Alaska,' 'Servia,' and so on?" and I believe most naval Officers would answer, with me, "No." To the second question, where he says, "Should we prepare to attack and blockade the enemy's ports notwithstanding his torpedoes?" I say "Blockade, yes; attack, no;" because I think you will waste your substance in preparing for the attack, until you have first banished his fleet from the sea. As to the kind of ship for the attack, of course, as I do not attack, I do not propose to build any ship for that purpose. In answer to Question 3—"Ought regular ships-of-war to be built of sufficient power and speed to capture ships like the 'Servia' and the 'Alaska,' and so on?" I say "No;" but it is essential to have a numerous array of ships, which would be the masters of the war ships launched to attack our commerce; and I think it is exceedingly dangerous to rely on the scratch services of the Mercantile Marine. As to the fourth, as to the powers of the ram and torpedo, I say we do not in the least know what part may be assigned to the ram and torpedo, and we shall never learn it by generalizing: but inductive reasoning and abundant experiment may, I think, teach us. I have, however, grave doubts as to the policy of the underwater armoured deck, and I am sorry to differ with my old chief (Admiral Ryder) so far. I still hold to the side armour, applied as it is in some foreign ships, with the horizontal armoured deck joining the upper edges of the side armour, the side armour being only carried up about 18 inches above the water. Then comes the last question—"Ought the battle ship of the first class to carry guns of the largest calibre which can be made and worked?" To that I say, I look to see the fleet ship with a more numerous artillery than they at present possess. If this cannot exist with the heaviest guns, then, I think, those guns will become lighter. Since I first began to consider these questions, there is no doubt that we are increasing, by all means in our power, the numbers of guns being carried in the fleet ships. At present it is a dual armament, that is to say, there are one or two very heavy guns, and a

numerous armament of light guns. I fully expect that the light guns will grow in size, and that the heavier guns will be reduced in numbers. I think the main point is this, that our material at present is a long way ahead of our power of judging what it means. I think we can only get at the rights and wrongs of the case by an earnest study of the historical and geographical facts; by close inductive reasoning, and by unstinted and abundant experiment. I think that these things are the wants of the day, and I consider they are things which, pursued steadily, will give us a true and reliable naval policy.

MR. GEORGE RENDEL (Lord Commissioner of the Admiralty): It seems to me that the all-important question raised by the distinguished author of this paper, and one which it is most desirable to bring to the test of naval opinion, is whether it is possible so to modify the construction of the Mercantile Marine, or rather of selected ships of the Mercantile Marine, as to render compatible with their trading qualities a certain measure of efficiency as ships-of-war, and thus to provide a large naval reserve always available for the protection of our commerce. I think that is a question which more than any other in the paper is one for the attention of the naval members present. What are the alternatives? As far as I understand the question, one alternative is to add to the Navy a number of very swift partially armoured vessels of war specially built to act as the guardians of our commercial ships. Now, there are one or two considerations which seem to make that course a very difficult one. In the first place the number of vessels required would be something enormous. If we make the supreme effort required to provide them, we have to remember that not only would their maintenance be extremely costly, but they would rapidly depreciate in value from the progress of science. As an example, if we assume that that course had been followed some fifteen years ago, we should certainly have had vessels engined in a manner that would have rendered necessary a complete refitting of engines and boilers a few years later, because it would be absolutely essential to maintain such vessels at the maximum point of efficiency, and for this purpose compound engines must have been substituted for the engines previously used. Again another period of a few years and we should have found ourselves in the presence of the fact that such vessels must be of steel, to cope with their rivals of the day. Again a reconstruction of the fleet. On the other hand, if it were possible to make the commercial navy self-protecting, or to a large extent self-protecting, we should be sure always to have in vessels selected for that purpose the latest improvements, and to have them at a very trifling cost, because naturally ships would drop out of the list as others of greater power came in. Then, instead of viewing with as much alarm as pride the growth of our great Mercantile Marine, we should view it with unmixed satisfaction. We should remove the perhaps greatest preoccupation of those who have to direct our naval policy and naval construction; in short, the object to be attained is so important that one cannot but think that a very careful examination of the question ought to be made. Already something has been done. A very few years ago there were but three or four vessels in the Mercantile Marine that could be said to be safe against the danger of being sunk by a single opening below water. Already, and absolutely without any expense to the country, by the initiation of the Admiralty, a large number of vessels have been built for the Mercantile Marine so divided as no longer to run the same risk. To a certain extent also the coal spaces have been rearranged to afford some protection to engines and boilers against artillery fire. Is it not possible to go further? If so much has been done without paying a single penny beyond the mere trifle spent for inspection, is it not possible to induce shipowners to construct vessels more adapted for being armed in time of war? To put their engines below the water-level, and to introduce a deck at or below the water-level,—to assimilate their ships in fact to the type we should probably build if we had to provide for the same duties by a special ship-of-war? The subject is one of such vast importance to the defence of the maritime interests of the country that it cannot be too thoroughly and carefully investigated.

Captain ORDE BROWNE, late R.A.: I want to raise one or two questions with reference to the three guns shown by Mr. Barnaby on the diagrams. I believe we require at this moment to take some important steps in order to understand the question of hard armour, and by hard armour I mean armour that cannot have a hole

made in it. Our guns and projectiles have hitherto been developed entirely against soft armour. The only diagrams we have in the Service relate to punching holes in iron armour. In the same way the chilled projectiles that form a great part of our stores were entirely intended for punching soft armour, and the new type guns owe their existence and position to the fact that it was found that you could penetrate soft armour with comparatively small guns. The whole of that applies to soft armour, and the whole of that, I believe, is liable to mislead us when once we have to deal with hard armour. The very success of those guns was suicidal; you had only to prove that you could drive a steel projectile, containing a bursting charge, clean through soft armour, and it would become quite clear that we must have something else, because naval architects would say it was much better to have steel armour that would smash up gradually than to have soft armour to let the shell go clean through and burst inside. The result is that by degrees steel-faced armour has been adopted. Supposing, as Mr. Barnaby assumes, that armour almost entirely goes out for ships, then you have to consider the question of hard armour for forts to a certain degree. Now we have to face this extraordinary result that, as soon as we try experiments with hard armour in this country, the first conclusion we come to is that our chilled projectiles are no use. Colonel Inglis will correct me if I am wrong. The Committee on Projectiles concluded that our chilled projectiles are of no use. And then we have brought into contrast with that this year the fact that the very best steel-faced armour that we can make is knocked to pieces by chilled projectiles at Spezzia and St. Petersburg, and by chilled projectiles whose stored-up work is only about a match for the armour. That is an illustration of the fact that we have been experimenting in this country a great deal too much on soft armour, and that we require urgently for the future to make experiments against hard armour of different kinds, chilled armour as well as steel-faced. We have never fired one round at Gruson's chilled armour in this country, notwithstanding the fact that all the forts of foreign countries are defended by chilled armour. The power of the guns for punching ships depends inversely upon the diameter of the hole you make, and the power of those medium guns is very great, because the diameter of the hole they make is small; but you cannot avoid having in some shape or other to attack chilled forts, and then you have to consider what the guns would do against them. Take those three guns and take their punching powers and their powers against hard armour. Their punching power is what they would do against ordinary iron armour, and their stored-up work represents their effect against hard armour. The following are the results: the 43-ton gun would penetrate 26.1 inches of iron, the 80-ton gun would penetrate 26.6 inches of iron; and the 100-ton B.L. would penetrate about 30.7. There is nothing grossly disproportionate in that. But now take the stored-up work as measuring the effect against hard armour. The 43-ton gun has a force of 23,320 foot-tons, the 80-ton gun 32,938 foot-tons, and the 100-ton B.L. 46,640 foot-tons. The last is exactly double the work of the 43-ton gun. The question we have to consider is, whether you can afford to have guns whose penetrating powers may appear to be not very much in excess of your own, but which, if brought to bear against hard armour, will produce twice the smashing effect of the biggest guns we have afloat.¹ I think those experiments are needed. This is only one branch of the question we have before us to-day, but it has occupied a certain amount of room in the paper and deserves attention.

MR. PROUNDES: The question of the Mercantile Marine has been brought very prominently before us to-day, and we have been favoured with valuable diagrams of the highest types of fast ships of the Mercantile Marine, but it has not been remarked that the necessities of merchant ships are altogether different from those of men-of-war as to high speed, a merchant ship during "her lifetime" requiring a high speed at all times on long voyages, economy of space and of consumption of coal being absolutely demanded. We all know that to obtain a good coefficient, we must have a very great length, so as to get the smallest possible immersed section, and to make the best use of our propelling power. It is also necessary to carry a large amount of cargo, and to have a very considerable

¹ Except those on board the "Inflexible."

space for passengers. But when we come to consider a fighting vessel, not necessarily a vessel for cargo or passengers, but merely a vessel to progress at high speed, then the naval architect has something very different to consider, and the very first point is as to propelling power. The propelling power that it would be possible to introduce into a merchant ship of large displacement would be altogether unsuitable in a very much smaller vessel; and I look forward to the time when we shall have great improvements in steam generators, in various forms of boilers, and also in small direct-acting engines, with screws of a smaller size, very high piston speed, more indicated power, and working with a greater degree of efficiency, and allowing us to have vessels of much smaller size, simply large floating gun-carriages, that would at the same time have a sufficiently ample storage of coal for any emergency. We do not require to build ships like merchant vessels; we require vessels irrespective of economical considerations with regard to the consumption of coal, &c.; vessels that can be economically worked under ordinary circumstances, but under *extraordinary* pressure can be worked up to the very highest speed possible. Therefore we have before us a possibility of building an entirely different type of ship, quite able to overhaul any of the very high speed steamers being projected now either at Barrow or Belfast or by any of the eminent builders, such as Harland and Wolff or others, for the several companies. The merchant service has been referred to by some naval gentlemen. As a matter of fact our merchant service is our great wealth. Not a single speaker has alluded to the necessity of assisting any of our Colonies. Captain Colomb has, however, frequently spoken on this question, but it has not been mentioned to-day. Indeed, from 1854 to the present day little or no progress has been made in the discussion that occurred on this subject when I was a youngster out in the Colonies, at the time when we first started in Victoria. Even then it was decided to have very high speed vessels, in case the Russians, with whom we were at war, attacked our "gold" ships; however, with regard to this subject, if it were in order to-day, I think I could show that our merchant service is really a great factor in the future. The paper to-day is not upon manning the fleet, but I think our Mercantile Marine, as shown on those two diagrams, could be made very valuable auxiliaries, especially if we had a few fast vessels, of an entirely different type, to protect and co-operate with them, able to overhaul and capture any high speed vessels that could be brought to bear against our Mercantile Marine. I believe these merchant vessels would make a much more practically useful school than our large ironclads can do, for our costly young naval Officers of the present day.

Captain J. C. R. COLOMB, R.M.A.: I rise to appeal to the meeting. I think there is a great tendency in the discussion for the whole matter to drift towards one point of the paper only, namely, the question as to merchant ships. Mr. Barnaby—the first authority in the world—comes and reads a paper, which I think is most suggestive, and he says his duty is to observe tendencies, and I take it also to weigh opinions. I appeal to naval Officers to speak out. Feeling, as I do, our great maritime danger, I do hope, Sir, this discussion will not close until many more naval Officers, I see present, who are capable of expressing an opinion, have entered more fully and more directly into the other most important parts of the paper which has just been read.

Mr. DONALDSON (Thornycroft and Co.): I was very much pleased to notice that Mr. Barnaby fully recognized the value of torpedo-boats in the defence of ports, and I think it would be a valuable addition to his paper if he were to give us some idea of the relative number of first-class boats suitable for this purpose in our own Navy and in those of France, Italy, and Germany. My firm has been engaged for some years in the manufacture of torpedo-boats, and large numbers are gradually being accumulated by the more important European Powers. We have manufactured twelve for England, twelve for France, and twelve for Italy, and I believe at the present time there are something like seventeen first-class torpedo-boats in the English Navy. The French have largely supplemented the number we have supplied them with by boats built in France, and now, I have been told, they have at least thirty first-class boats in their Navy. Only a few months ago an Italian constructor told me he had an order from the Italian Government for thirty first-class boats, made from our drawings. Germany is making torpedo-boats very largely also, and if Mr.

Barnaby could give an appendix to his paper showing the exact number of torpedo-boats belonging to these different countries I think it would have a very important bearing on the question before us.

Captain HARRIS, R.N.: I am somewhat diffident in making any remarks on the valuable and highly instructive paper and discussion which we have just had the pleasure of hearing. There are, however, one or two points which seem to have escaped observation. It strikes me as a very serious question, and one worthy of deep consideration, that the moment war breaks out we should propose to take all the steamers which from their high speed could not be captured by the enemy, and which, generally speaking, could run with celerity from port to port with almost perfect impunity, and turn them into armed cruisers, when these would be the very ships wanted at that time to supply our hungry people with food. I think, therefore, that it is a very open and somewhat doubtful question whether these fast steamers should be taken away from commerce for war purposes, leaving, as we see so admirably illustrated in Mr. Barnaby's diagram, that large and helpless mass of slow steamers and sailing-vessels to carry out and provide for the never-ceasing wants of our teeming town populations. There is another point I should wish to briefly mention, it is as to the policy of the Italians in building these very large ships. No doubt the building of an enormous ironclad is to a certain extent a menace to England, because we are the most powerful nation afloat. But there is another way of looking at it, and I think if we could persuade nations like Italy, and even larger nations, to throw their whole resources and strength into monster armour-clads, when their finances will certainly not permit the construction of more than three or four of them, that we then with our more numerous vessels should have no difficulty in mobbing them in their own ports. Thus I think Signor Brin's policy of making a comparatively poor nation build very expensive and enormous ships is a good policy for England. I may say that I quite agree with Admiral Boys and Captain Colomb as to the inversion of the first paragraphs of this paper. I think they stand altogether on their wrong base, and that in reality our large and extended Mercantile Marine is a great source of danger and anxiety to us, and cannot be regarded in any way as a source of strength but as a necessary weakness to be jealously guarded and defended. Mr. Barnaby has made one remark with which I most cordially agree, that is, as to whether it is wise to introduce large guns afloat. My opinion on this subject is, that the Navy as regards its readiness to take heavy guns is a long way ahead of the supply, indeed of any gun we have yet got afloat; judging from the facility with which we have passed from a 6½-ton gun to a 100-ton gun, I think it may be safely predicted that we are quite capable of efficiently working guns of much greater power in all ships. It seems to me that putting in small guns is simply waste of time, because we have, so far, not nearly reached the limits of either size or power in this matter of naval guns.

MR. BARNABY: I think I need, perhaps, to offer a few explanations at once, and those are, first, as to what I mean by a battle ship, and, next, what is meant by a protected ship, and I must confess it is very difficult for me to say. We talk commonly about armoured ships and unarmoured ships. These two great Italian ships ("Italia" and "Lepanto") have not any armour on their sides at all, they have armour for the protection of their guns, but they have none upon their sides. We have ships in our Navy and ships are being built in England, for foreign Powers, with very strong protecting decks, either below or just above water, such as those which have been talked about by Admiral Ryder (I remember, of course, perfectly well all that he has been referring to: I think he was a little ahead of the times, as I am to-day). But there needs some change in the terms that we use. We cannot stick to the terms armoured and unarmoured, as at all marking the difference between the classes of ships with which we are now dealing. There are protected ships which you cannot call "armoured" ships. If you call them "unarmoured" ships you degrade them into positions they ought not to be in, because being what I call "protected," that is, having no side armour, but strong protecting decks, it may be that they are capable of fighting with the battle ships. In my opinion they are. In my opinion ships of 17 knots, with powerful guns, and a protecting deck from end to end, with engines, boilers, and steering apparatus all protected, with the deck, if you will, so situated with regard to the water, that your floating

power and stability are both preserved, cannot be properly called unarmoured ships. We are not at liberty to call them armoured ships, so I call them protected ships.

What are "battle ships?" Captain Colomb says: "I call certain ships fleet ships." Well, why? "Because you may expect to find them fighting in fleets." Well, you may expect to find any of those ships, which I have called battle ships, fighting in fleets. Some of the ships which are there we call "coast defence ships," but the fact that they are coast defence ships is shown by the smallness of their size. They do not actually count as battle ships, but I have put them in the diagram because I consider that those ships can fight, in proportion to their size, as well as the others. In the French Navy there are ships of great power which they call "coast defence," but which are as well able to fight a battle in the Mediterranean as any of the ships they have. Therefore, I have to explain that these might be called ironclad ships rather than battle ships; but I defend the term I have used, because those ships might be expected to be found in battle in any part of the world where you could send them. With regard to the experiments that Captain Orde Brown referred to, I am entirely of his opinion that we need experiments very badly indeed in order to ascertain what is the gradual increase of resisting power as you thicken armour-plates. I do not know what it is, and it is absolutely necessary that experiments which have for some time gone on rather slowly should be taken up with more vigour than we have recently been able to show in that matter, because of their great cost. The armour of to-day is exceedingly costly.

I should have been glad if I had been able to say that the answers to the questions had convinced me that the opinion of this meeting was so and so; but at present I am not able to say anything beyond this, that you are certainly of opinion that at present, whatever it may be our duty to do with regard to the merchant shipping of England, we cannot regard it as a very great power for ourselves. My question has been, ought we not to try to make it so?

The CHAIRMAN: I have only now to ask you to enable me to give your thanks to Mr. Barnaby for the very admirable paper that he has read to-day. I am quite sure when Mr. Barnaby says he fails to sum up any results from the discussion, you will not expect me to attempt to do it. I, therefore, have only to thank Mr. Barnaby on your part, and my own, for his very able paper.

Friday, February 16, 1883.

LIEUT.-GENERAL SIR EDWARD B. HAMLEY, K.C.B., K.C.M.G.,
R.A., Member of Council, in the Chair.

THE EFFECTS OF THE BOMBARDMENT OF THE FORTS
OF ALEXANDRIA, JULY 11TH, 1882.

By Captain N. L. WALFORD, R.A.

PART I.

SIR EDWARD HAMLEY, LADIES AND GENTLEMEN,

It is perhaps scarcely necessary to draw your attention to the value of a detailed report of the effects of the bombardment of Alexandria, since we are all aware of, and all appreciate, the fact that this is the first occasion on which modern ships, armed with modern guns, have engaged land batteries armed with similar weapons.

The bombardment of Sebastopol, and of the Russian forts in the Baltic and the Black Sea, are now as useless, as far as regards the worth of any information to be obtained from their history, as are the bombardments of Algiers or of Acre, and if we turn to more recent engagements, such as those which took place during the war between Chili and Peru, we shall, I think, find that, at least in the majority of cases, such bombardments consisted merely of the destruction, by ships armed with long-range guns, of cities and towns of which the defenders possessed no ordnance of sufficient power to molest the attacking force.

With these few introductory remarks, for our time is limited, I pass on to the subject of my paper.

Defences of Alexandria.

The city of Alexandria is situated on a strip of land between the Mediterranean Sea and Lake Mariout; a considerable portion of it stands on a promontory, which, jutting out towards the north-west, is bounded on the north-east and south-west by the New and the Main Harbours. (Plate V.)

Strictly speaking, the sea defences of the city extend from Fort Silsileh to Fort Meks, a distance of about 6 miles; the action, however, of some portion of the fleet during the bombardment included also Fort Marabout, which is about 9 miles from Silsileh.

The defences consist of the following forts and lines:—

(i.) *Fort Silsileh*, which guards the south-east corner of the New Harbour.

To the south-west of this fort stands the Quarantine Fort, of which it is not proposed to give any details, since it was not affected by the bombardment.

(ii.) *Fort Pharos* or *Kaid Bey*, standing at the north-west corner of the New Harbour.

(iii.) *Fort Adda*, about 800 yards to the west of Pharos.

Between these forts is a lunette of good profile, but of poor armament: it was not engaged on the 11th of July, and need not be again mentioned.

(iv.) To the south-west of Fort Adda, on the opposite side of a small bay, is the right battery of Ras-el-tin lines. This is generally named *The Hospital Battery*, since it stands in front of a large building bearing that name on the map.

From this point the lines follow the coast, until at the north-west angle of the Harem (or Children's Palace), they widen into a battery, which has been generally spoken of as the Moncrieff gun battery. Since, however, this is completely a misnomer, it will perhaps be better to call it *The Centre Battery*.

Thence the lines, following the shore, run on to the south-west to the *Harem* or *Left Battery*, a small work of no great defensive value; from this last they extend as far as Fort Ras-el-tin. The total length of these lines is about 1,500 yards.

(v.) *Fort Ras-el-tin*. This work lies at the extreme point of the spit of land which forms the north-west shore of the Main Harbour; it guards the breakwater, and covers the narrow passage between the latter and the coast.

(vi.) On the opposite side of the harbour stands the small fort *Saleh Aga*; it is in part old, is altogether obsolete, and requires little further notice.

(vii.) About a mile to the south-west of Saleh Aga stands a fort named *Oom-el-Kubeba* (the Mother of the Little Dome). This is a very old and in many ways a very remarkable fort, but is not well suited to modern weapons. Between Saleh Aga and Oom-el-Kubeba stands a small battery armed with four guns.

(viii.) A few hundred yards to the south-west of Oom-el-Kubeba is *Fort Kamaria*, a poorly-armed redoubt, which calls for but little notice.

(ix.) The *Meks Sea Lines*, which commence about 400 yards to the south-west of Kamaria, extend along the shore for a distance of about a mile. The left flank is covered by—

(x.) *Fort Meks*. This fort stands at the junction of the sea and land lines, of which the latter, extending nearly to Lake Mariout, defend Alexandria from the attack of an enemy who may have been landed at some point further to the south-west.

The *Citadel*, or *Fort Namusia*, took some little share in the defence.

Beyond the Meks lines stands an insignificant work, named *Marsa-el-Kanat*, while at a distance of more than 3 miles from the former are the large forts, Marabout and Ajami.

Composition and Armament of the Attacking Fleet.

The Mediterranean Squadron, upon which devolved the task of bombarding the above-mentioned defences, consisted of the ships mentioned in the following table, in which their armament is also included:—

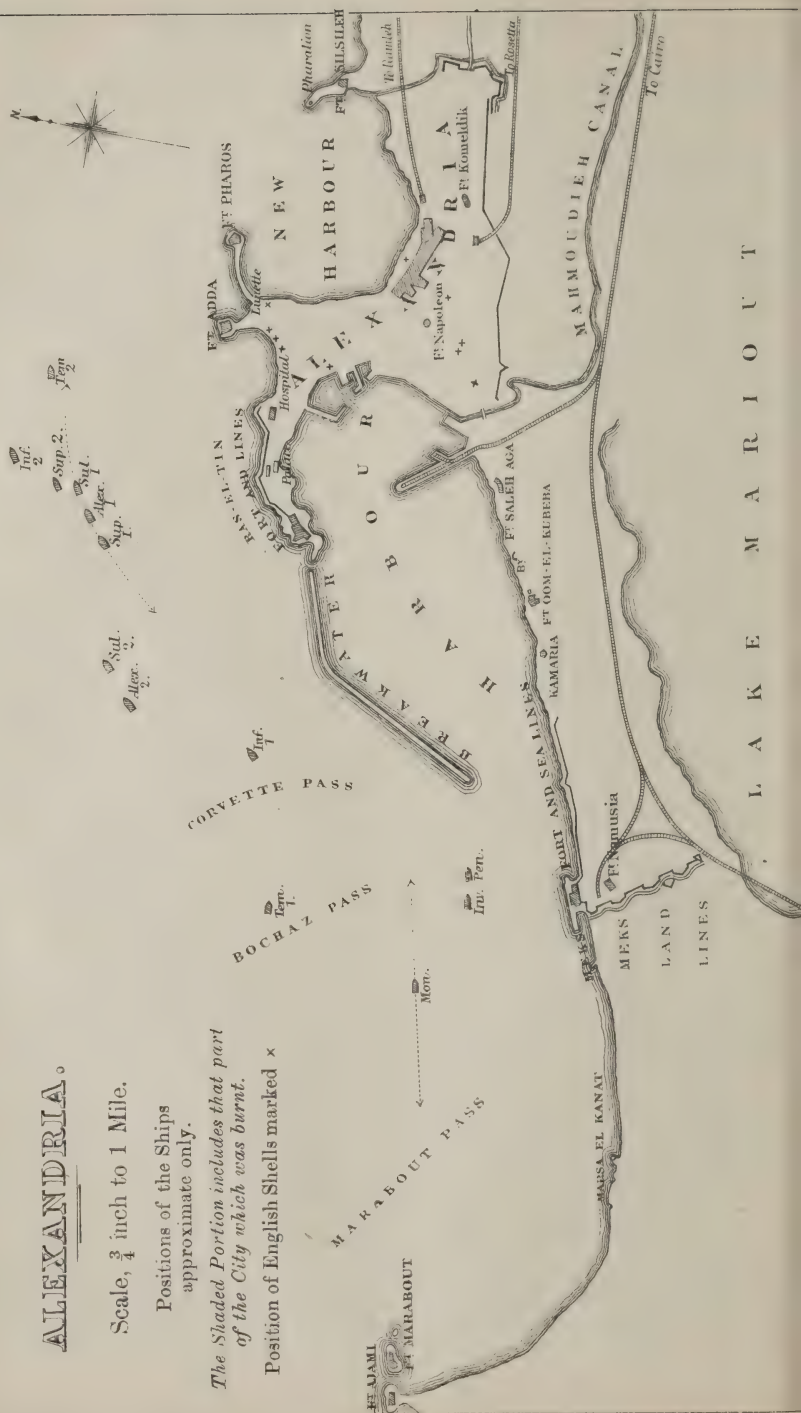
ALEXANDRIA.

Scale, $\frac{3}{4}$ inch to 1 Mile.

Positions of the Ships
approximate only.

*The Shaded Portion includes that part
of the City which was burnt.*

Position of English Shells marked x



Ships Engaged in the Bombardment.

Ship.	Guns.									
	16"	12"	11"	10"	9"	8"	7"	64	40	Total.
"Alexandra" .....	..	..	2	10	..	..	..	..	..	12
"Inflexible"	4	..	..	..	..	..	..	..	..	4
"Superb" .....	..	..	..	16	..	..	..	..	..	16
"Sultan" .....	..	..	..	8	4	..	..	..	..	12
"Temeraire" .....	..	..	4	4	..	..	..	..	..	8
"Invincible" .....	..	..	..	..	10	..	..	4	..	14
"Monarch" .....	..	4	..	..	2	..	1	..	..	7
"Penelope" .....	..	..	..	..	..	8	..	..	3	11
Total.....	4	4	6	38	16	8	1	4	3	84

Each ship had in addition from 6 to 8 20-pr. R.B.L. guns, and also from 8 to 12 machine-guns.

Gunboats, &c., "Beacon," "Bittern," "Condor," "Cygnet," "Decoy," and "Helicon."

The Action of the Fleet.

The fleet was divided into two squadrons, as follows:—

"Alexandra"	}	Outside Squadron.
"Superb"		
"Inflexible"		
"Sultan"		
"Temeraire"	}	In-shore Squadron.
"Invincible"		
"Monarch"		
"Penelope"		

From the commencement of the action (about 7 A.M.), the stations were as follows:—

(1st phase. 7 A.M. to 10.30.) The "Alexandra," the "Superb," and the "Sultan" engaged the forts and batteries from Ras-el-tin to Pharos.

These ships were under way until about 9.30, and up to that time engaged at a range of from 1,500 to 2,400 yards. They then anchored at a range of from 2,200 to 3,550 yards, firing principally on the Ras-el-tin Fort and lines.

The "Inflexible," stationary but not anchored, engaged Fort Ras-el-tin (at 2,700 yards), and Oom-el-Kubeba (at 4,000 yards).

The "Invincible" and the "Penelope," at anchor, at a range of 1,500 yards, engaged Fort Meks.

The "Monarch," under way, at various ranges, engaged Meks Fort and lines, and Oom-el-Kubeba.

The "Temeraire," at anchor, at a range of 4,000 yards, supported the "Invincible" and the "Penelope."

(2nd phase. 10.30 A.M. to 1.30 P.M.) At or about 10.30 A.M. Fort Ras-el-tin and Meks Fort were silenced.

The "Alexandra" and the "Sultan" then engaged the West Battery (Harem), which was silenced about noon; they then attacked the Centre Battery.

The "Superb" engaged Adda, and the "Temeraire" Pharos, while the "Inflexible" divided its attention between these two forts.

The "Monarch" finally silenced Oom-el-Kubeba, about 1 P.M.

(3rd phase. 1.30 P.M. to 3 P.M.) At 1.20 a shell from the "Superb" blew up the magazine at Adda, which was then silent.

The "Temeraire," "Inflexible," and "Superb" continued to bombard Pharos, which was silenced about 2.30 P.M., at which hour also the Centre (Moncrieff) Battery ceased to reply to the "Sultan" and "Alexandra."

The "Inflexible" and the "Temeraire" then turned their attention to the Hospital or Bluff Point Battery; this was silenced by 3 P.M., but, venturing on the 12th again to open fire, it was finally silenced by seven rounds from the same ships.

Between 3 P.M. and 5.30 P.M. (at which latter hour all firing ceased by signal), a few shots were fired at the forts with the object of preventing the garrison from attempting to bring their guns again into action.

The "Alexandra" also threw some shell into Fort Silsileh, while in the earlier part of the day some of the gunboats had been employed in shelling Fort Marabout, and in covering with their fire a landing party which succeeded, without opposition, in dismounting some of the guns at Fort Meks.

As many of us are accustomed to judge of the size of a gun by the weight of its shot rather than by its calibre in inches, the following table is added:—

Details of Heavy Ordnance used at the Bombardment of Alexandria.

Gun.	Weight of gun in tons.	Charge in lbs.		Empty shell, weight.		Bursting charge, weight.	
		Service.	Battering.	Common.	Palliser.	Common.	Palliser.
				lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.
16-inch gun ..	80	337·5	450	1640 0	1684 0	60 0	16 0
12 " " ..	25	55	85	590 10	608 6	23 6	5 10
11 " " ..	25	60	85	526 0	543 2	22 0	4 14
10 " " ..	18	44	70	390 7	406 0	19 9	4 0
9 " " ..	12	30	50	241 8	253 5	14 8	2 11
8 " " ..	9	20	35	166 0	174 12	15 2	4 8
7 " " ..	6·5	14	30	106 14	112 1	9 4	2 10

The general Character of the Defences and of their Armament.

The various forts and lines which together compose the sea-defences

of Alexandria differ considerably from each other in trace and profile, but they have many points in common to which it may be well to allude.

The *parapets* are without exception of sand, which is covered with a thin coating of cement; this is sufficient to prevent the wasting of the slopes by weather, but not to stop the growth of vegetation, and is so friable that it even breaks under the tread.

The interior slope, which is always revetted with stone, is invariably vertical; the superior slope has an inclination of about 5° , and the exterior of about 35° ; the latter has generally one or more berms of 1 or 2 feet in width.

The *escarp*, except where it is very low, and the few counterscarps which exist, are revetted. The stone which is used for the revetments is a very soft limestone of no tenacity, and the mortar has but little binding power. The stores and buildings in the forts are constructed of the same material. The parapets in front of the rifled guns, which without exception fire through embrasures, are revetted to a height of 7 feet 6 inches; the parapet rises about 18 inches above the revetment with a counterslope of $\frac{1}{4}$. The S.B. guns, with rare exceptions, fire over a low parapet.

The *embrasures* have at the sill a width of 5 feet, which narrows to 3 feet 3 inches at about 18 inches from the neck; the splay is about 60° , and the cheeks of all embrasures are revetted with stone.

The *traverses* in the batteries for rifled guns are all fitted with expense magazines of the ordinary type.

No effort is made to give flank defence to any portion of the forts, nor, except at Silsileh and Oom-el-Kubeba, is there any instance of the use of a ditch.

The *buildings* in the forts are none of them bombproof, nor, except in Pharos, are there any casemates or covered batteries.

The Armament.

Rifled Guns.

10-inch M.L.R. Armstrong gun.

9 " "

8 " "

7 " "

40-pr. B.L.R. Armstrong gun, S.S.

These guns very closely resemble those in our Service, and call for no remark.

Smooth-bore Guns.

15-inch, about 10 tons, a magnificent weapon.

10-inch, in four sizes, from about 50 cwt. to about 8 tons.

6.5-inch or 36-pr., a poor gun, reputed to be of French manufacture.

10-inch howitzer, only one example.

Mortars.

20-inch, a very fine piece.

13-inch, S.S. and L.S., very like our own.

12-inch, a French mortar, in shape not unlike that on the Horse Guards Parade.

11-inch.

Carriages, &c.

The carriages and platforms of the rifled guns so closely resemble the Service pattern that little need be said of them. The racers are of iron, and are sunk in stone beds.

The platforms have invariably fixed pivots, which are, however, set in such inferior masonry that the stone has in many cases given way and jammed the front trucks of the slides. The holdfasts also have in one or two cases yielded to the shock of the recoil.

The carriages of the S.B. guns are all of wood, and are as a rule old and rotten; they have no elevating screws, and the guns have no sights, being laid with a quadrant, of which the arm is inserted in the muzzle.

The trucks are sometimes of wood for the lighter guns, but are as a rule of iron.

The platforms of the S.B. guns are, if possible, more rotten than the carriages; those of the smaller guns have two or three bearings, all fitted with trucks, but the 15-inch and the heavy 10-inch have a fourth bearing, which is a wooden chock.

The trucks of the platforms run on planks, which are arranged in a polygon, and are sunk flush with the ground.

The garrison carriages and their platforms are of the ordinary pattern; they are entirely out of repair.

Ammunition.

Rifled Guns.—The *shell* are similar to our own, but are studded and have no gas-checks; there are three kinds—Palliser, common, and shrapnel, and some of each stand by the guns. It appears probable that the shell were filled at the gun, since in one or two cases funnels were found in the gun portions.

The *cartridges* were filled with powder of a cylindrical form, made by Curtis and Harvey. It would seem that, as a rule, no filled cartridges were kept in the magazines, since in Fort Ras-el-tin only were any metal-lined cases found. From the appearance of the magazines it is probable that the cartridges were filled during the action, and the process must have been much delayed by the small size of the weights and scales. It is possible that this fact may account for many faults in the fire of the Egyptians, since it is not unlikely that the charge was frequently below the regulation weight. The cartridges for the S.B. guns were rough canvas bags, and were filled with a highly glazed L.G. powder.

Fuzes.—For rifled guns—

(a.) A time-fuze of gun-metal.

(b.) A large gun-metal percussion-fuze.

(c.) A small ditto.

(d.) A wooden fuze, similar to Boxer's time-fuze for rifled ordnance.

These fuzes are all of English make.

For S.B. guns and mortars were used four or five sizes of a rough wooden fuze, graduated but not numbered. It was sawn or cut, and not bored, to the required length.

Tubes. (i.) The ordinary service copper friction-tube.

(ii.) A short copper friction-tube (Egyptian), of which the detonator is fixed to a twisted copper wire, which forms a loop for the hook of the lanyard.

(iii.) A tube filled with mealed powder, to be fired with a portfire.

The *lanyards* had a wooden handle, which the number who fires the gun can grasp firmly.

The armament of the various forts is given in the following tables:—

Rifled Guns.

Forts, &c.	Mounted.					Unmounted.		Total.
	10" M.L.	9" M.L.	8" M.L.	7" M.L.	B.L. 40-pr.	10" M.L.	9" M.L.	
Silsileh .....	..	1	1	..	..	..	2	4
Pharos	1	3	2	..	2	..	..	8
Adda	1	3	1	..	..	..	..	5
Ras-el-tin Lines	1	3	2	2	1	..	..	9
Ras-el-tin Fort.....	1	4	1	..	..	..	..	6
Oom-el-Kubeba .....	..	..	2	..	..	..	..	2
Meks Fort.....	1	1	3	..	..	2	4	11
Total	5	15	12	2	3	2	6	45
	37					8		

Smooth-bore Guns and Mortars mounted.

Fort or Battery.	Guns.			Mortars.				Total.
	15"	10"	6·5"	20"	13"	12"	11"	
Fort Silsileh.....	..	3	..	..	1	..	..	4
„ Pharos .....	..	6	31	..	4	..	..	41
„ Adda .....	..	14	..	..	5	..	..	19
Ras-el-tin Lines	4	15	11	1	6	1	2	40
Fort Ras-el-tin.....	2	5	21	..	1	..	2	31
„ Saleh Aga .....	..	4	8	..	..	..	..	12
Battery .....	..	2	2	..	..	..	..	4
Fort Oom-el-Kubeba ..	..	6	10	..	1	..	1	18
„ Kamaria .....	..	2	3	..	1	..	..	6
Meks Sea Lines	4	11	9	..	..	..	..	24
„ Fort.....	..	4	5	..	3	..	2	14
Total.....	10	72	100	1	22	1	7	213
	182			31				

Ordnance mounted.

Fort or Battery.	R. guns.	S.B. guns.	Mortars.	Total.
Fort Silsileh.....	2	3	1	6
„ Pharos.....	8	37	4	49
„ Adda.....	5	14	5	24
Ras-el-tin Lines	9	30	10	49
Fort Ras-el-tin.....	6	28	3	37
„ Saleh Aga .....	..	12	..	12
Battery.....	..	4	..	4
Fort Oom-el-Kubeba	2	16	2	20
„ Kamaria .....	..	5	1	6
Meks Sea Lines .....	..	24	..	24
„ Fort	5	9	5	19
Total.....	37	182	31	250

*Effects of the Bombardment on the various Forts, &c.**Fort Silsileh.*

This work stands at the extremity of a promontory which forms the eastern boundary of the New Harbour, and is connected by a partially ruined causeway with a still more advanced work of no defensive value, styled on the map Pharalion. Fort Silsileh has a semi-circular front, and a parapet of considerable height, of which the ditch forms a species of *faussebraye*. The upper parapet only is armed. (Plate VI.)

The magazine, which is of considerable size, was reported to contain large quantities of gunpowder; it lies underground, and is further, to some extent, covered by a stone tower, which serves as a *réduit* to the fort.

The stores, &c., stand on the left front of the fort, and are entirely exposed to the enemy's fire. They are well stocked with shells, fuzes, &c.

In rear the work is divided from the mainland by a dry ditch, provided with a revetted counterscarp and escarp, the latter of which has a *chemin des rondes*. The ditch is also flanked by a stone caponier, as is also the eastern sea face.

The armament of Fort Silsileh was—

One 9-inch M.L.R. Armstrong gun.

One 8-inch „ „

Three 10-inch S.B. shell guns.

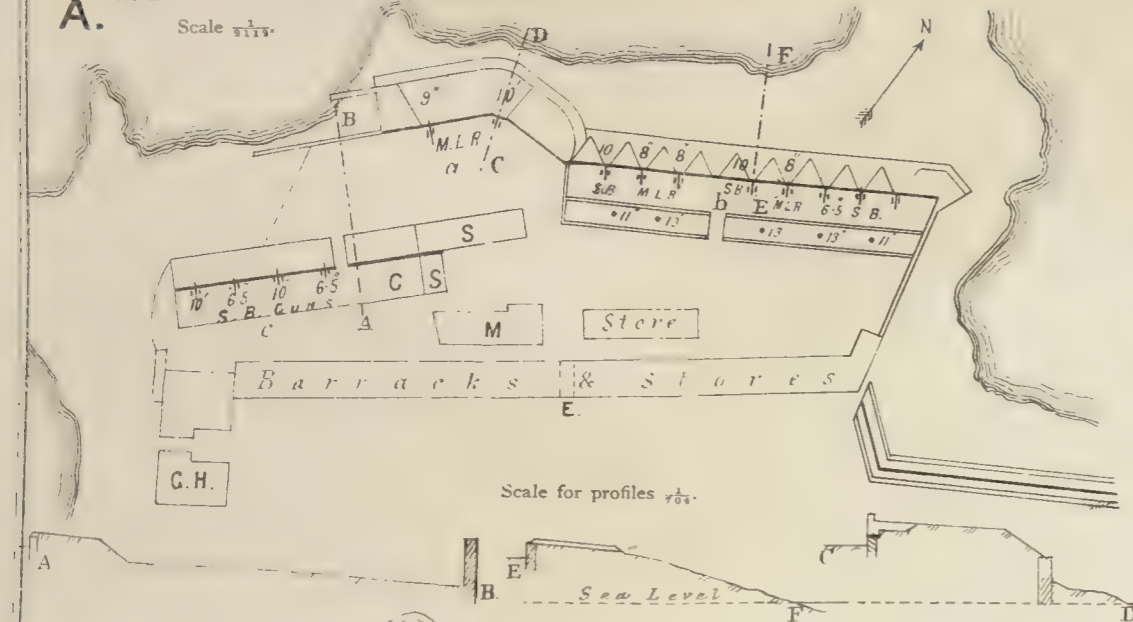
One 13-inch S.S. mortar.

In addition to the above, two 9-inch M.L.R. guns were lying dismounted under the west side of the tower; these were destroyed with gun-cotton by the Navy.

The fire of the “Alexandra” does not appear to have in any way injured the guns or stores of this fort, though fragments of at least

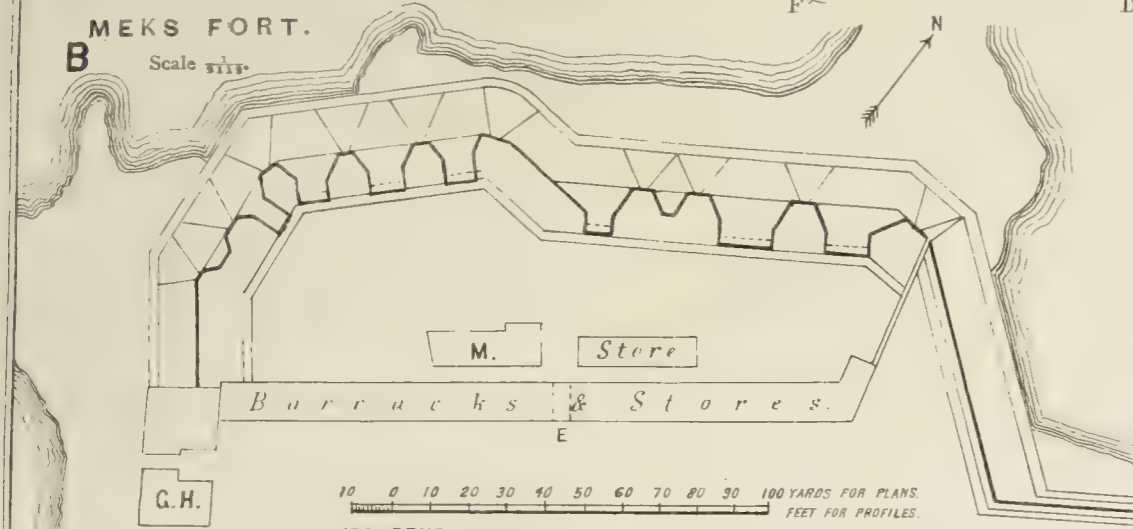
A. MEKS FORT.

Scale $\frac{1}{112}$.



B. MEKS FORT.

Scale $\frac{1}{112}$.

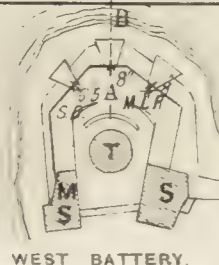


REFERENCES.

Guns.....
Guns Disabled ...
Mortars

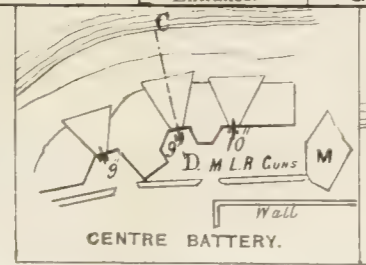
LETTER REFERENCES.

M—Magazine. S—Store.
E—Entrance. G H—Guard House.



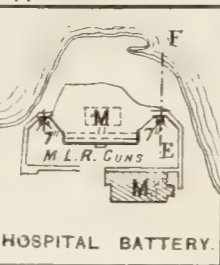
WEST BATTERY.

Scale $\frac{1}{112}$.



CENTRE BATTERY.

Scale $\frac{1}{112}$.



HOSPITAL BATTERY.

Scale $\frac{1}{112}$.

Palace

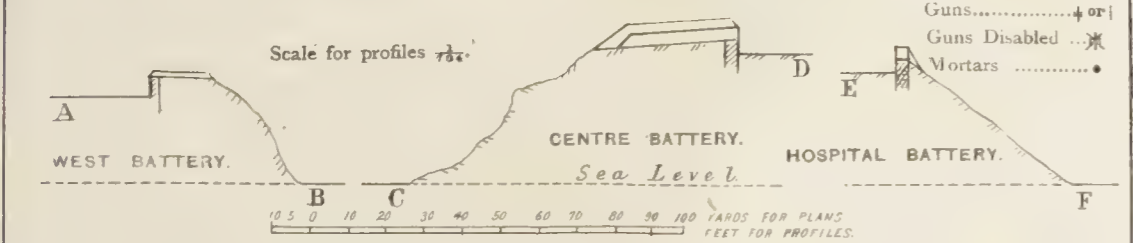
LETTER REFERENCES.

M—Magazine.
T—Tower.
S—Store.

REFERENCES.

Guns.....
Guns Disabled ...
Mortars

Scale for profiles $\frac{1}{112}$.



FORT RAS-EL-TIN.

Scale $\frac{1}{112}$.

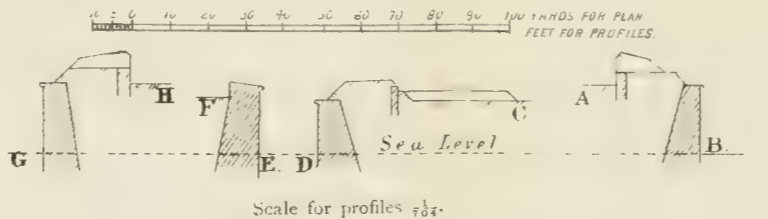
LETTER REFERENCES

S—Store.
M—Magazine.
E—Entrance.
L H—Lighthouse



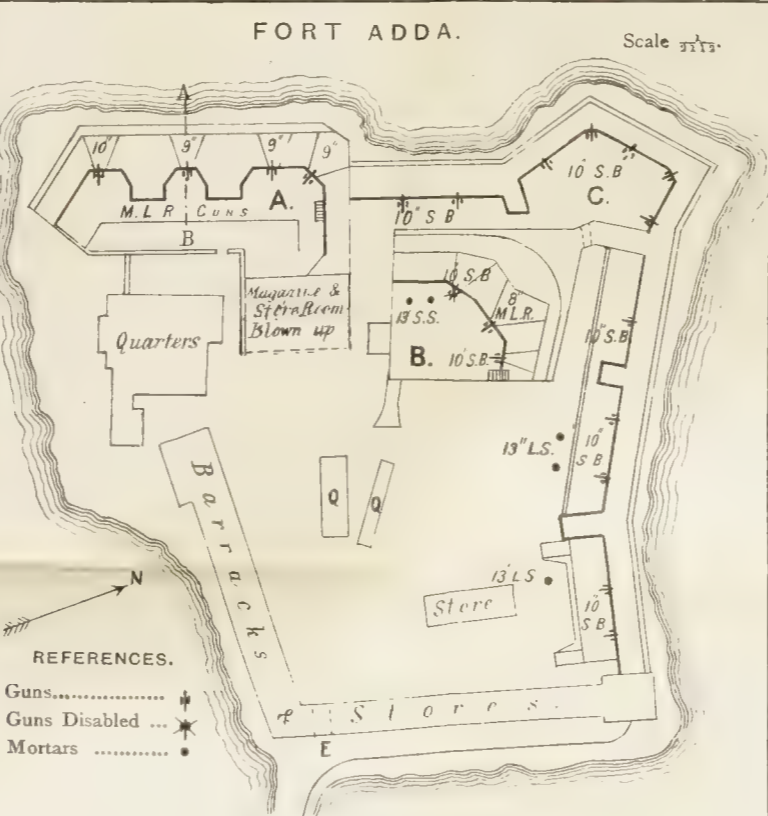
REFERENCES.

Guns.....
Guns Disabled ...
Mortars



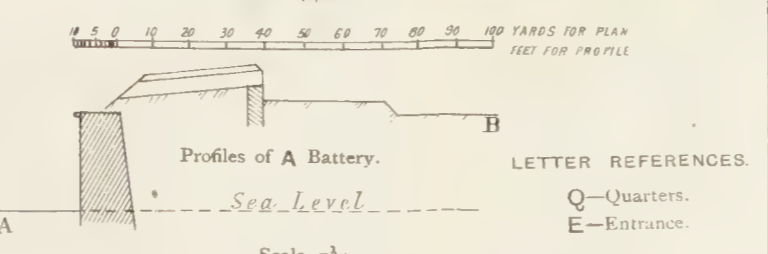
FORT ADDA.

Scale $\frac{1}{112}$.



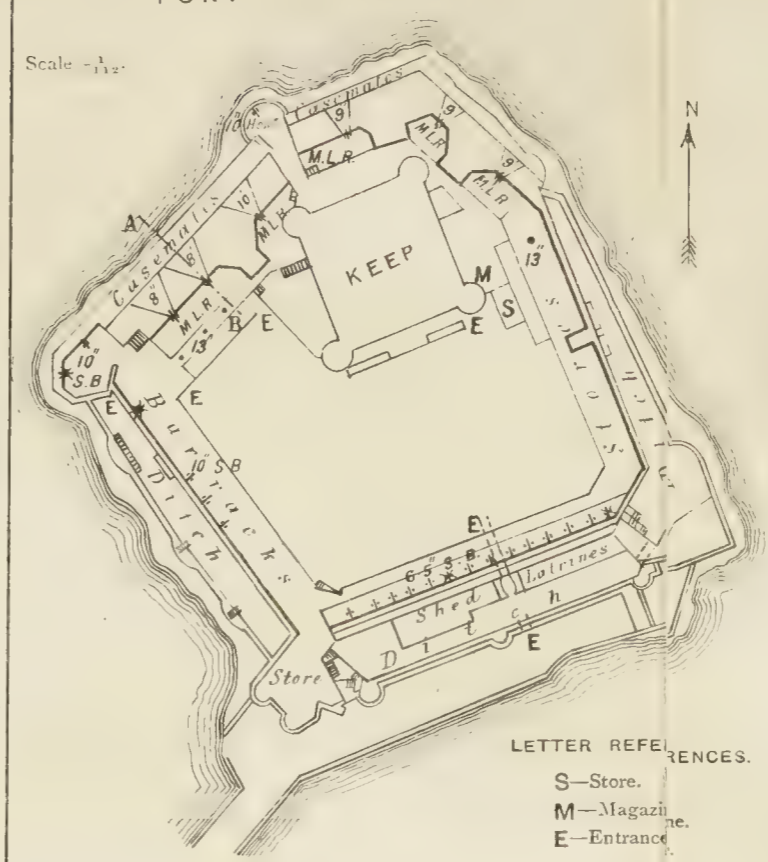
REFERENCES.

Guns.....
Guns Disabled ...
Mortars



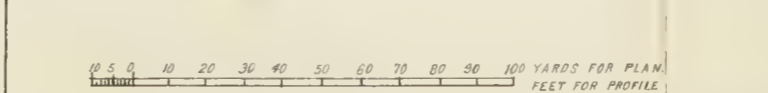
FORT PHAROS OR KAID BEY

Scale $\frac{1}{112}$.



LETTER REFERENCES.

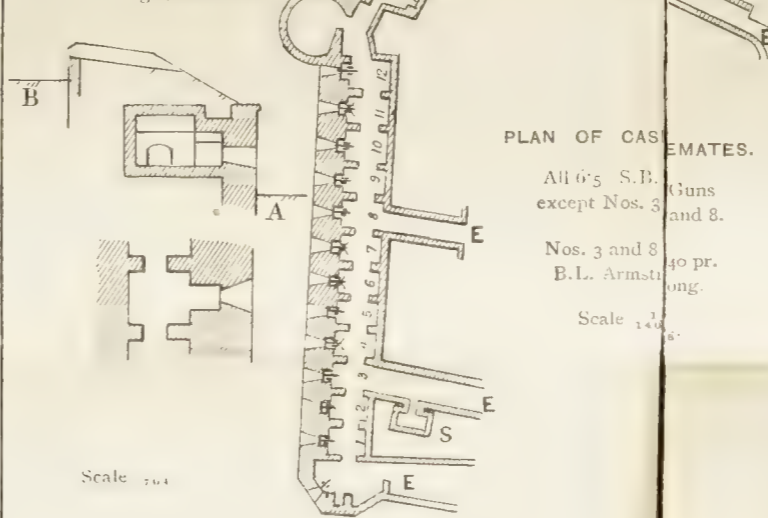
S—Store.
M—Magazine.
E—Entrance.



REFERENCES.

Guns.....
Guns Disabled ...
Mortars

Profile showing Casemates.



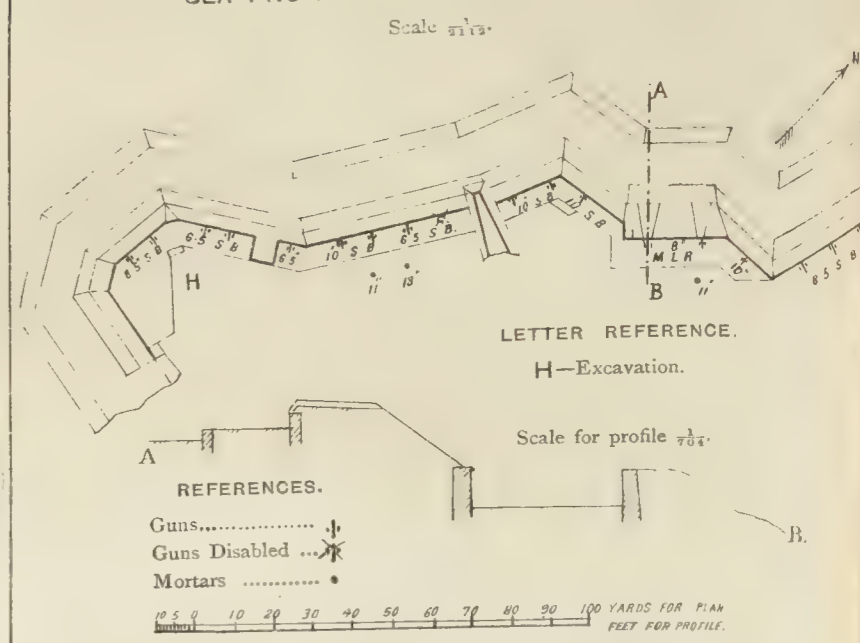
PLAN OF CASMATES.

All 6.5 S.B. except Nos. 3 and 8.
Nos. 3 and 8 B.L. Armstrong 40 pr. long.

Scale $\frac{1}{112}$.

SEA-FRONT OF FORT OOM-EL-KUBEBA.

Scale $\frac{1}{112}$.



LETTER REFERENCE.

H—Excavation.

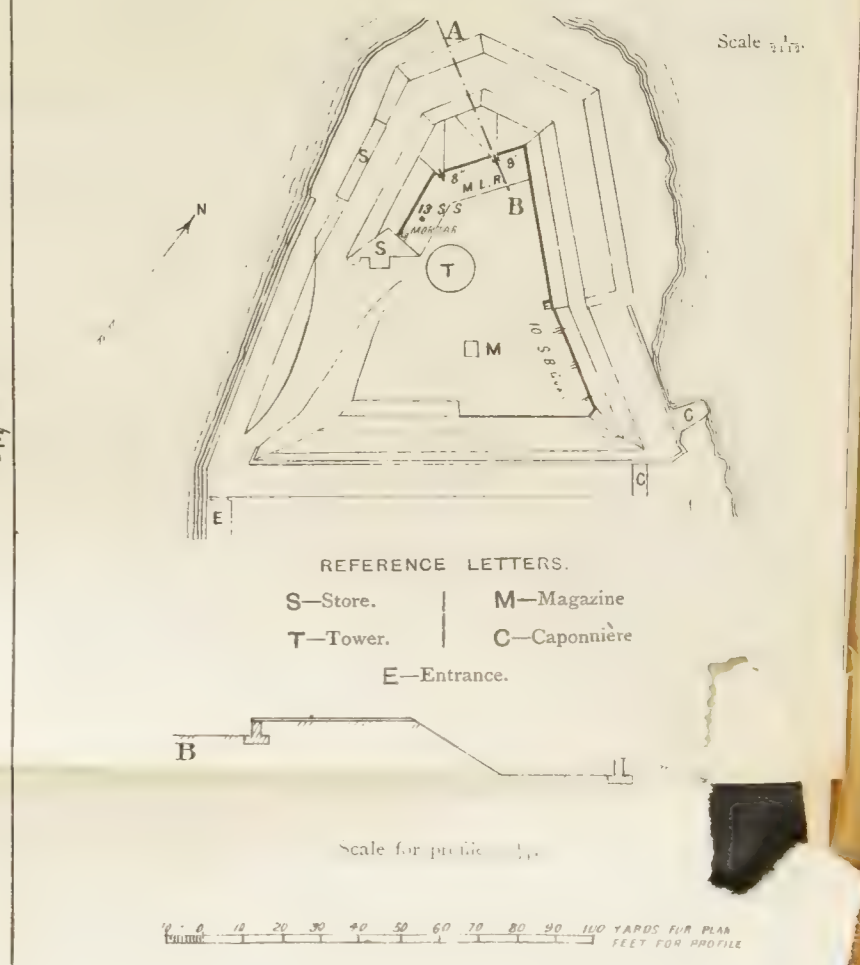
Scale for profile $\frac{1}{112}$.

REFERENCES.

Guns.....
Guns Disabled ...
Mortars

FORT SILSILEH.

Scale $\frac{1}{112}$.



REFERENCE LETTERS.

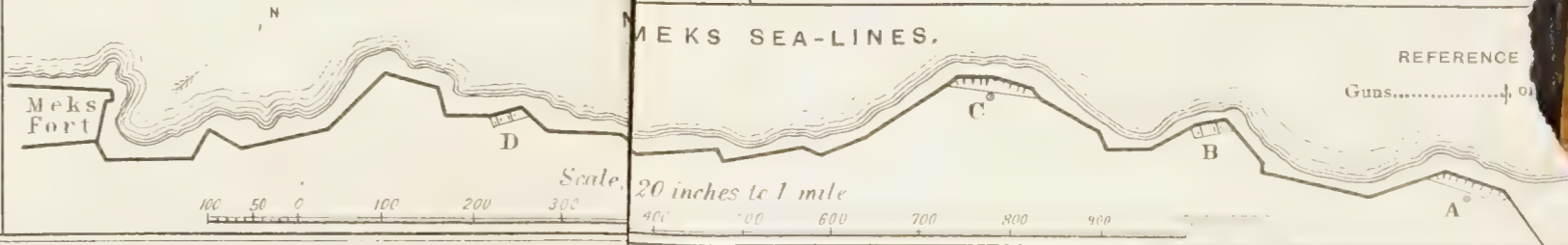
S—Store. M—Magazine
T—Tower. C—Caponnière
E—Entrance.

Scale for profile $\frac{1}{112}$.

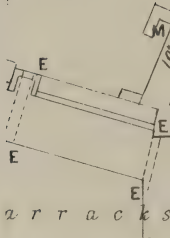
MEKS SEA-LINES.

REFERENCE

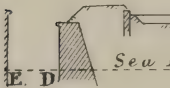
Guns.....



RT RAS-EL



40 50 60 70 80



two shells lie around the rifled guns. In the ditch in rear of the work are two blind 10-inch R. common shell, of which one is fitted with a percussion-fuze, while that of the other has blown out.

Fort Pharos.

This fort, which is named by the Egyptians Kaid Bey (after a Caliph of that name who lived in the fifteenth century), stands at the end of a stone causeway about 500 yards in length, which forms the northern boundary to the New Harbour. This was probably the site of the old Pharos when the above was the only harbour of Alexandria.

Fort Pharos is of various dates; the oldest part of the work is the keep, a massive rectangular stone tower of about 110 feet side, and about 60 feet in height. At each angle stands a round turret, while in the centre of the rear face was a small pharos or light-tower, which was destroyed in the course of the bombardment.

In the keep is a mosque, but the greater part of the building consists of galleries which were used as quarters. Many pieces of old carved alabaster and many granite columns are built into the walls.

The exterior walls to the south and west must also be of considerable age, since they consist of circular towers connected by long curtains, while the old entrance in the south-west corner (marked Store) is a copy in miniature of the gateway of a Norman castle.

Other parts have been built after the introduction of artillery, and others again after guns had come into general use; but of the whole fort no part has at the present day any real defensive value except the battery on the sea front.

This work must be of very recent date, since it is in all ways adapted to modern rifled ordnance.

The parapet is about 22 feet thick, and has a command over the sea level of 40 feet. The escarp has a height to the cordon of 23 feet, and the terreplein of the battery is 12 feet above the parade of the fort.

All the buildings and revetments of the fort are constructed of the stone of which mention has been made, and none of the former have any pretensions to being bombproof.

The magazine is partially protected by the keep, but is entirely above ground; it stands in a part of the fort which was not bombarded by the fleet, but has narrowly escaped a chance shell, which burst on the adjacent turret. At the time of my first visit (about August 1st) the magazine was empty, while in front of it were piled sixty-two barrels which had contained pebble powder.

The casemates which lie under the sea front are of ordinary construction; the thickness of the front wall is 7 feet 10 inches, and the depth of the casemates is 16 feet. There are four entrances (marked "E"), one from the west ditch, and three by covered ramps from the interior of the fort.

The armament of Fort Pharos is given in the following table:—

Position.	M.L.R.			B.L.	S.B. guns.			Mrtrs.	Total.
	10"	9"	8"		10" H.	10" L.	6·5"		
Sea front.	1	3	2	..	..	..	..	3	9
On west tower ..	..	..	..	..	2	..	..	..	2
On west front ..	..	..	..	..	..	4	..	..	4
On rear face....	..	..	..	..	..	..	14	..	14
On east face....	..	..	..	..	..	..	..	1	1
In casemates....	..	..	..	2	..	..	17	..	19
Total.....	1	3	2	2	2	4	31	4	49
	6				37				

Effects of the Bombardment.

The ships appear to have lain on the 11th July in a position due west of the fort, for the west tower and front are breached in many places, and the whole of the west front of the keep, with its two turrets, is in ruins.

The south-east corner of the fort is also much shattered by the shells which have passed over the west front.

The stores and barracks have suffered very severely, and the destruction of so much masonry must have added considerably to the moral effect of the fire of the ships.

With regard to the sea front, the only part of the fort which has any defensive value the parapet, has been hit in several places (seven in all), but in only three cases has a shell entered the battery.

The corners of the traverse to the right of the 8-inch guns have been carried away by two shells, but one of these has done no real damage, while the effects of the second, which has choked the racers of the right-hand 8-inch gun with earth, could be remedied by half-an-hour's work.

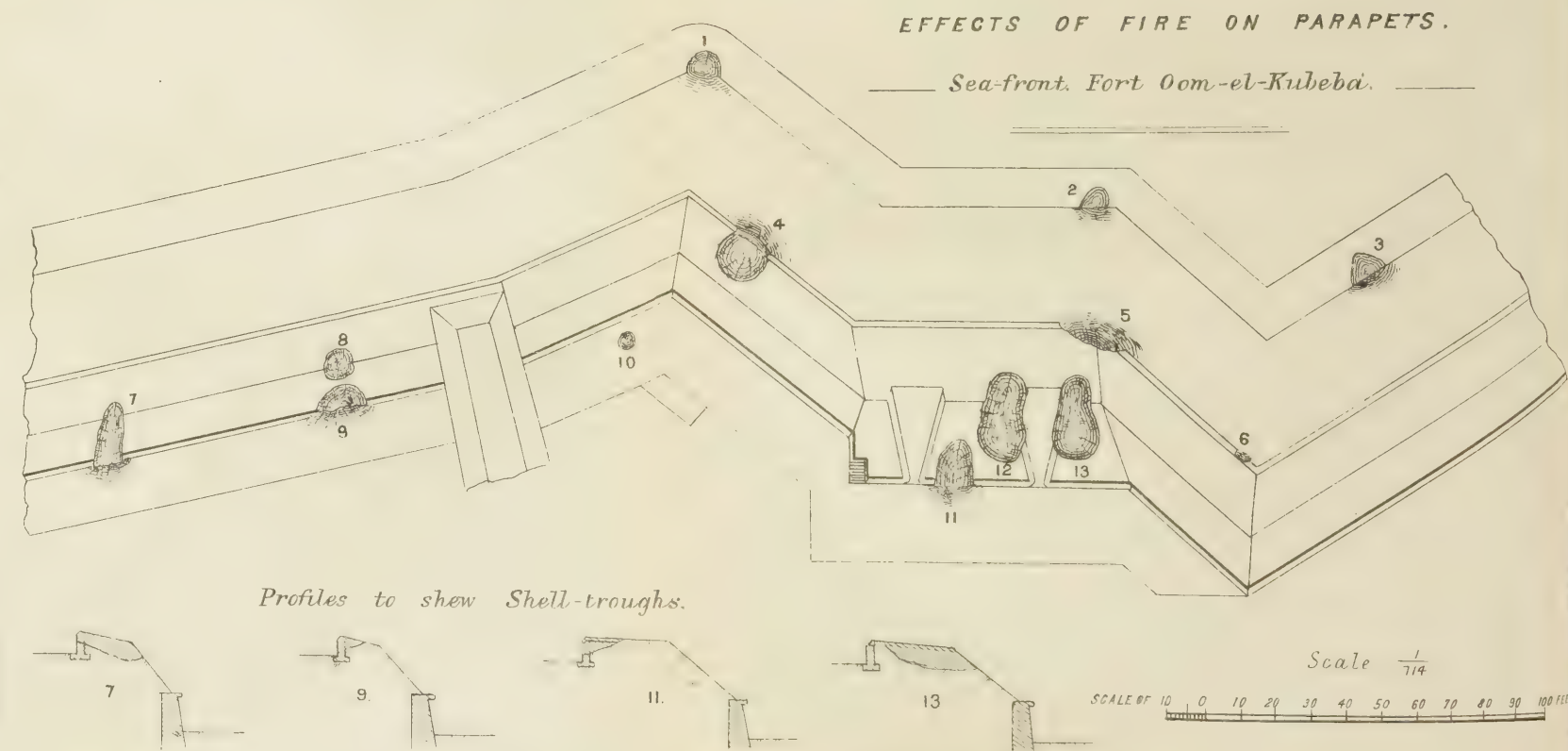
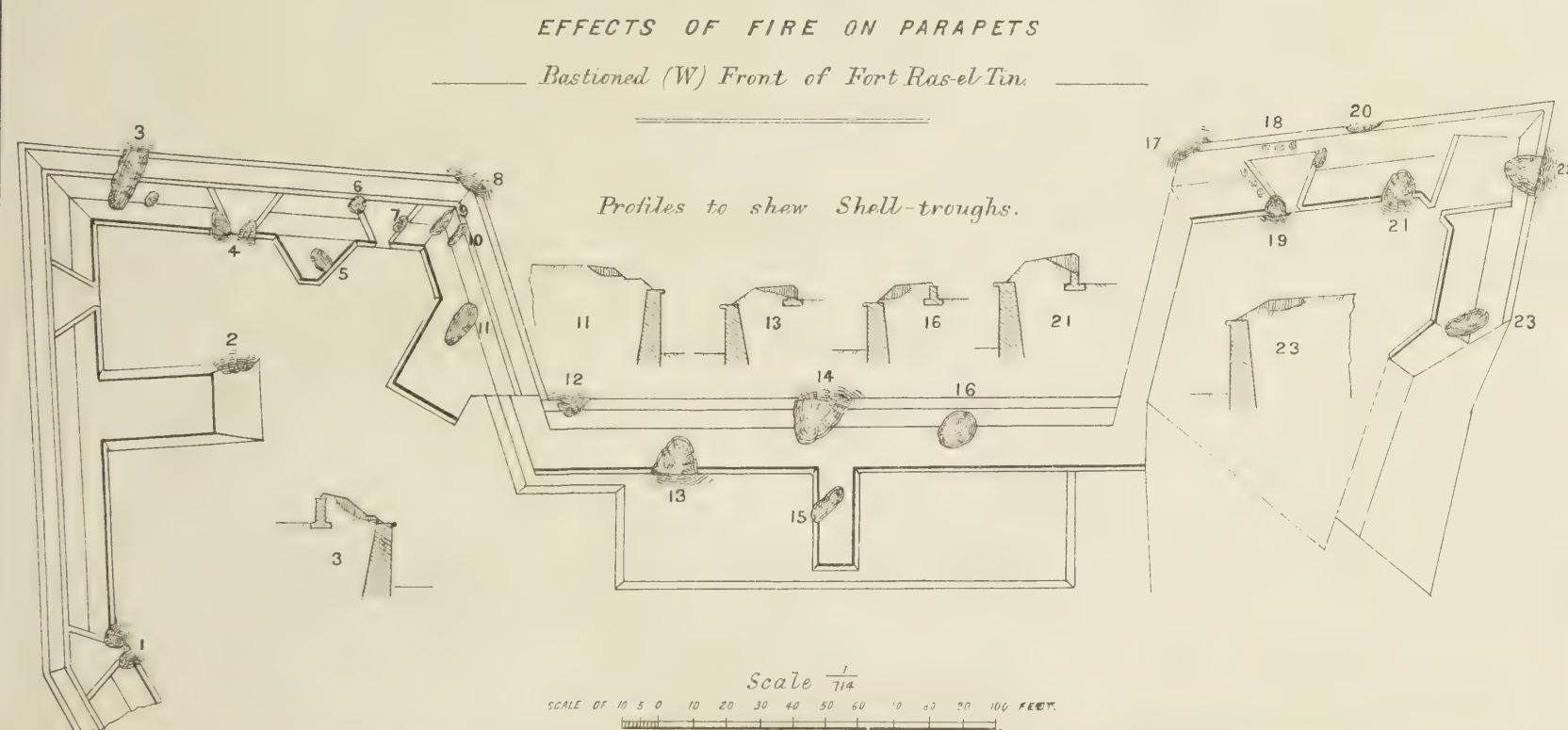
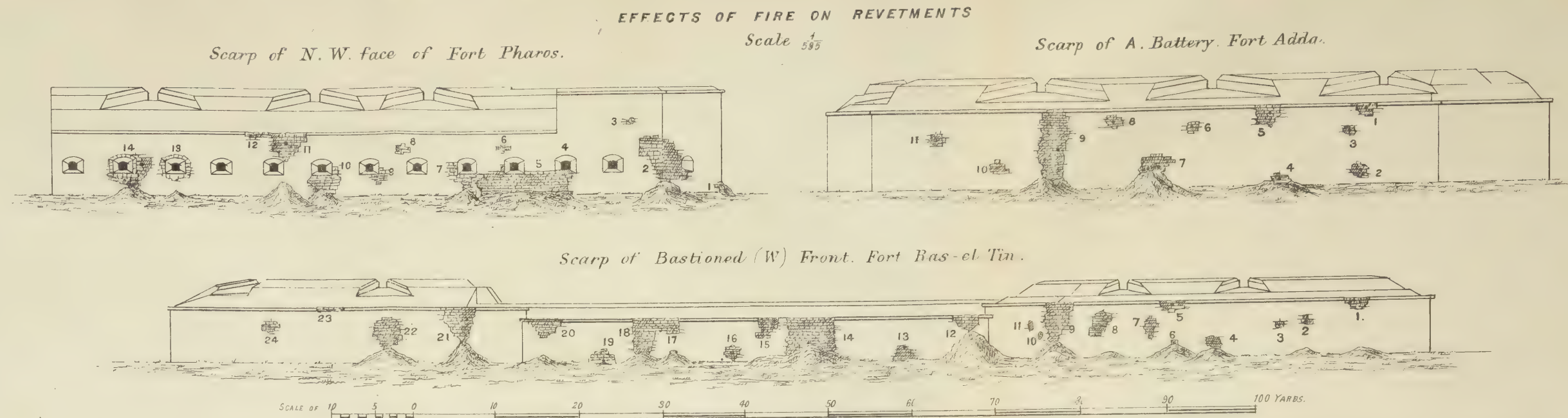
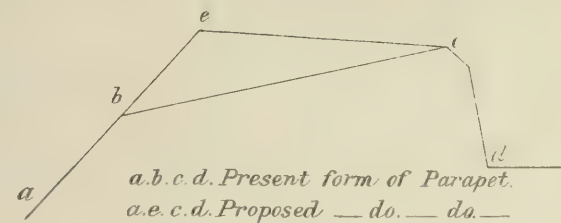
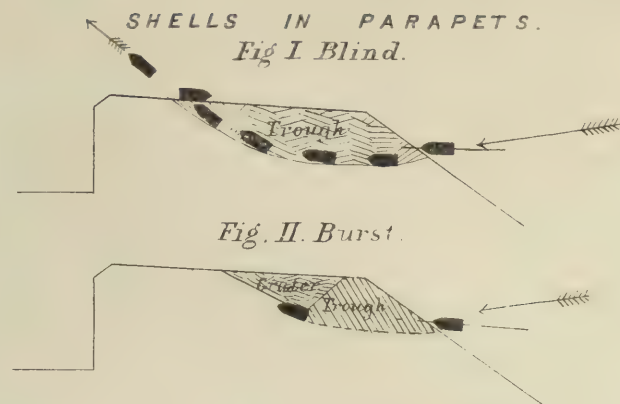
A third shell has pierced the sole of the embrasure of the 10-inch M.L.R. gun, and bursting has thrown the large granite block which formed the sill on to the platform of the gun. The *débris* of the embrasure have jammed the trucks on the racers, and the gun is further covered with stones which have fallen from the ruined turret above it. The holdfast of the slide was also carried away, and the gun is out of action.

Not one of the guns,¹ carriages, or slides were in any way injured.

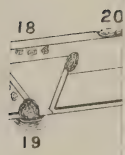
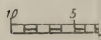
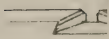
Owing to the position taken up by the bombarding ships the three 9-inch guns were unable to bear on them, and do not appear to have been fired.

Of the S.B. guns, one heavy 10-inch on the west tower has been dismounted, gun and carriage, by a 16-inch shell; one 10-inch shell

¹ It is not proposed to take any notice in this paper of the fact that many of the M.L.R. guns in this and in other forts were burst after the action with gun-cotton charges.



W. face



gun on the west front has been capsized and put out of action, and it is not unlikely that another, with its carriage, has fallen into the crater formed by a shell.

On the rear face a 36-pounder having been hit on the cascable by a chance shell has been thrown completely over the parapet, and is now, after passing through the roof of a shed in the ditch, standing on its muzzle at a distance of 30 feet from its original position. Another gun is also unserviceable, owing to the partial destruction of its carriage by a shell.

But it is in the casemates that the fire of the ships has inflicted the greatest injury.

The front wall of the casemates is faced with ashlar masonry about 2 feet in thickness, but this course has in many places fallen away under the stress of fire, leaving no further protection to the guns than might be given by about 6 feet of rubble wall of inferior quality; through the latter the heavy shells pierced with ease. The results were as follows:—

Under west tower, casemate penetrated, gun not disabled.

No. 1. Casemate. Carriage blocked with splinters from the embrasure.

„ 2. Gun and carriage utterly wrecked, both being thrown back into the casemate.

„ 3. 40-pr. B.L. Armstrong. Uninjured.

„ 4. Shell has burst under the platform, and ruined gun and carriage.

„ 5. Serviceable.

„ 6. Embrasure beaten in on the gun.

„ 7. Is pierced by two 10-inch Palliser shells. Gun and carriage entirely wrecked.

„ 8. 40-pr. B.L. Armstrong. Serviceable.

„ 9 and 10. Uninjured.

„ 11. Gun and carriage destroyed, and thrown to the back of the casemate.

„ 12. Carriage blocked with splinters from the embrasure.

Of the five casemates on the right sea front No. 17 only, in which there was no gun, has been hit.

All the guns in the casemates (6·5-inch S.B.) were mounted on garrison carriages, which stood on ordinary wooden platforms.

The loss of life in the casemates must have been out of all proportion to the effect produced by the feeble guns which were mounted in them; yet, strange to say, their defenders continued to fight after the rifled battery above had been silenced.

On the escarp of the casemates Nos. 1 to 12 there were about thirteen hits, of which seven pierced the wall.

Fort Adda.

This work, like the preceding, stands on an island, and is connected with the mainland by a causeway about 200 yards in length. It has been of late years partially altered as to its profile, with the object of rendering it more suitable to modern ordnance.

It is, speaking roughly, a fort of four sides, of which the southern and eastern consist of stone buildings, which were used as barracks and stores.

On the southern half of the western side stands a strong cavalier battery (A); it has a command of 40 feet above the sea, and a parapet about 30 feet in thickness, while the scarp, which is revetted, has a height of 28 feet to the cordon. It is divided into three parts by two traverses, in which are expense magazines, while the main magazine and shell-room stood to its right rear.

To the north of the latter stands a second cavalier battery (B), of which the general level is about 12 feet below that of A. Its parapet is 27 feet thick, while the escarp, which is revetted, has a height of 10 feet.

In front of this last work lies a low sea battery (C), which has a command of only 10 feet above the sea, with a thickness of parapet of from 15 to 24 feet.

The parapet which forms the north side of the fort has about the same level and profile as C, and, like the latter, has its guns mounted *en barbette* on traversing platforms.

The guns in A and B Batteries are similarly mounted, but fire through embrasures.

The armament of Fort Adda is given in the following table:—

Position.	M.L.R. guns.			S.B. guns.		13" mortars.		Total.
	10"	9"	8"	10" H.	10" L.	S.S.	L.S.	
A Battery	1	3	..	..	..	..	..	4
B " .....	..	..	1	..	2	2	..	5
C " .....	..	..	..	4	3	..	..	7
North front .....	..	..	..	..	5	..	3	8
Total.....	1	3	1	4	10	2	3	24
	5			14				

Effects of the Bombardment.

The barracks and stores, especially on the east side of the fort, were very much injured by the fire of the fleet, but the batteries were not materially damaged. The only shell which has entered the A Battery is that which, just cutting through the crest, plunged into the magazine and blew it up.

Of the character of this magazine it is impossible now to speak, but since some walls are still standing, it is probable that it was entirely above ground. A shell-store appears to have been in the same building, and was most likely in rear of the magazine, since the shell which it contained have been blown *into* the fort. The loss of life from the explosion was probably very great, as the entire space

between the magazine and the gate is covered with stores, timbers, and broken shell.

The parapet of A Battery has been hit by seven shell, and its escarp by fourteen; the latter is also much marked by shrapnel bullets.

B Battery, on which were two hits, is uninjured, as is also C Battery, which likewise received two shell.

The injury done to the ordnance was as follows:—

The 10-inch Armstrong gun in A Battery has been struck on the muzzle by a shell, but is not materially damaged; a more serious disaster has arisen from the fact that the holdfast of the slide has given way, and the trucks have in consequence left the racers. Thus the gun, though uninjured, is unserviceable; efforts have been made to lift the gun with five lifting-jacks, which are still *in situ*. The other guns are uninjured, except that in one instance the sockets for the running-up levers have given way.

In B Battery a 10-inch S.B. gun has been dismounted by a shell, which has thrown the gun and carriage to a distance of about 15 feet from the slide.

In C Battery, the left, the 10-inch S.B. gun, has been similarly dismounted; while the right gun, a heavy 10-inch S.B., has been struck on the left side of the platform by a shell which has previously cut off the cascable of the second gun to the left; the beams of the platform, about 12 inches in thickness, are completely shattered, and the gun with its carriage is overturned and wrecked.

There can be no doubt but that the defence of this fort could have been easily prolonged had it not been for the explosion of the magazine, which not only must have killed a considerable number of the garrison, but must also have destroyed all the powder in the fort, as well as a large proportion of the shells for the M.L.R. guns.

Ras-el-tin Lines.

The right of these works rests, as has been before stated, on a small battery which stands on a bluff point jutting out towards the sea.

This it is proposed to call—

(A.) The Hospital or Bluff Battery.

It was to have consisted of two gun portions divided by a large magazine, but was unfinished at the time of the bombardment: it was, however, to judge by the material on the spot, and the scaffolding erected, in rapid progress towards completion.

The terreplein of the battery has a command of about 50 feet above the sea, which washes the foot of the small hill on which the work stands.

The magazine, which is about 30 feet by 14 feet, is well protected, the thickness over all of that portion of the parapet being 45 feet: on the other hand, the gun portions and the retired flanks of the battery had, on the 11th of July, scarcely any parapet, and the gun detachments were consequently protected (?) from fire by merely a 3-foot wall.

The armament of the battery consisted of two 7-inch M.L.R. Arm-

strong guns, mounted on traversing platforms, and firing through (what would have been) embrasures.

The effects of the bombardment on the battery are, as might be expected, overwhelming: the two gun portions are so entirely destroyed that it is difficult to discover where the original crest has been. The magazine, which appears to have been empty, is untouched, as is also a smaller and older magazine which lies in rear of the battery.

The injuries to the guns are as follows:—

Right Gun.—The cheeks of the embrasure are driven in on the gun, and the trucks are in consequence jammed: otherwise the gun and carriage are uninjured. The former is, however, scored with forty-nine hits from the bullets of a 10-inch shrapnel shell which burst about 30 yards in front of the gun: the greatest depth of any hit was .5 inch.

Left Gun.—The gun, carriage, and slide are uninjured, but a shell having burst under the front racer on the left side of the gun, has torn it up and bent it into a vertical plane, twisting the truck in its socket, and forcing it off the racer. The slide is also jammed by the ruins of the revetment.

Considering the ruined condition of the battery, the fact that the guns are uninjured is most remarkable, while that they were fit for service is proved by the circumstance that about the middle of August, 1882, they were moved to the position of Ramleh, for the purpose of firing on the enemy's lines.

To the south-west from the Hospital Battery runs a continuous line of works, which stands from 15 to 25 feet above the sea level, and has a parapet from 12 to 24 feet in thickness: it follows the coast round a small bay which lies to the north of the Palace, and thence in a direction parallel to the north wall of the Harem or Children's Palace. At the north-west corner of this wall it joins the centre battery, mis-called the Moncrieff Gun Battery.

This portion of the line (660 yards) contains the following armament:—

B. A battery of two 10-inch S.B. guns.
two 11-inch mortars.

C. Two 10-inch S.B. guns.

D. A battery of four 10-inch S.B. guns.
three 13-inch mortars.

One of the guns is dismounted, and one of the mortars has burst.

E. A single 10-inch S.B. gun.

F. Three 6.5-inch guns.

All these guns are mounted on traversing platforms, and fire over a low parapet.

There is a store for rifled guns in rear of B and of E.

G. The centre battery.

This work possesses considerable strength, the parapet having a thickness of about 32 feet. The escarp is not revetted: the level of the terreplein is about 33 feet above the sea.

The battery is divided into three gun portions by two traverses containing expense magazines:

The armament of the battery consists of—

One 10-inch M.L.R. gun.

Two 9-inch M.L.R. guns.

The guns are mounted on traversing platforms and fire through embrasures, the parapet being about 7 feet 6 inches in height.

Effects of the Bombardment.

Though the parapet is deeply scored in all directions by shells, yet the interior of the battery is almost uninjured; the embrasure of the left gun (9-inch) is, however, choked up by the ruins of the cheeks, while the revetment on each side of the neck has been swept away.

The condition of the guns is as follows:—

10-inch (right gun).—The right front truck of the carriage has been carried away; the buffers of the slide are much damaged by the recoil of the gun; the masonry of the holdfast has started, and the ties are almost off the pin.

9-inch (centre).—The gun, carriage, and slide are uninjured, except that the lever of the elevating gear is bent, and the holdfast is rising off the pin.

9-inch (left gun) has been hit on the left trunnion by a shell which has torn off the capsquare, and also by a second shell on the right bracket 6 inches in rear of the trunnion hole. The gun and carriage are, however, practically uninjured, but the trucks of the slide are jammed by the fall of the revetment, and the holdfast is rising off the pin.

This battery is that which was, in the early reports of the bombardment, miscalled the Moncrieff Battery, but there is in it no one gun mounted on that system. The misnomer probably took its rise from the fact that a gun so mounted stands about 180 yards to the west of the battery.

The intervening space is occupied by—

H. A battery of three 36-prs. S.B.

I. A battery of two 36-prs. S.B.

A large magazine lies under a traverse on each flank of the centre battery.

J. The Moncrieff gun.

This gun, a 9-inch M.L.R. Armstrong, mounted on a Moncrieff carriage, stands alone on a point which projects into the sea. It is neither sunk in the ground, nor covered by a parapet, and standing nearly 12 feet high, offers a conspicuous mark for fire. It was not fired on the day of the bombardment, nor could it be fought in its present condition with any advantage or hope of success.

It was hit on the left side of the carriage by a splinter of a shell, and a bolt in the rear of the left bracket was also cut out by a Nordenfelt bullet. Beyond these it has received no hurt, and is perfectly serviceable.

Passing on to the westward there are in succession—

K. A battery of two 13-inch mortars.

one 12-inch mortar.

L. A bastion containing two 15-inch S.B. guns and one 13-inch mortar.

M. A battery of six 10-inch S.B. guns.
two 36-pr. S.B. guns.

In rear of M. stands a very fine 20-inch mortar.

N. The left (or Harem Battery.)

This work is a small bastion of little defensive power, since it is so cramped, and so entirely devoid of traverses that it is a mere shell-trap.

It has a command over the sea of about 28 feet, and the parapet has a thickness of 13 feet.

In the centre of the work stands a loopholed round tower, to which access is obtained through an underground passage which is entered from one of the stores. Of the latter there are two which stand on the rear face on either side of the gate: there is also a magazine in the left rear of the work.

The armament of this battery consisted of—

Two 8-inch M.L.R. Armstrong guns;

One 36-pr. S.B. gun;

which were all mounted on traversing platforms and fired through embrasures.

The effects of the bombardment on the fort are small, but the loss of life must have been considerable, as many shells have burst in it. The rear face of the tower is in ruins; the shells appear to have burst on meeting the second wall, after piercing the first.

The damage done to the guns is as follows:—

Right Gun (8-inch M.L.R. Armstrong).—A 9-inch Palliser shell, entering through the embrasure, has struck the lower side of the gun; glancing from this, it appears to have burst on the breast of the carriage, with the following results:—The gun, except a dent 8 inches in length on the under surface, is uninjured, but has been thrown about 10 feet from its original position. Both brackets of the carriage are torn away; of these the right bracket lies under the gun, while the left bracket has been blown to the other side of the work, a distance of 22 yards. The entire carriage is a wreck, and the battery is strewn with fragments of angle-iron, &c. The compressor bars of the slide are twisted, the rear transom broken in two, and the rear trucks dislocated, though still on the racers.

Centre Gun (8-inch M.L.R. Armstrong).—The right front truck of the carriage is broken, and the gun is struck by a splinter on the chase. The gun and the carriage have, however, suffered no serious injury, though the left bracket of the latter has been in addition pierced by a splinter.

The 36-pr. is uninjured and was probably not in action.

This little fort, of no great value at the beginning, was probably indefensible at the end of the action.

Between the West Battery and Fort Ras-el-tin, which forms the left pivot of the lines, lies only one battery of two 15-inch guns, the remainder of the parapet being furnished with a banquette for infantry. In rear of the 15-inch battery is a large magazine, underground and in complete safety, but several large stores, which are visible from the sea, have been set on fire by the shells of the fleet.

Close under the north wall of the barrack of Ras-el-tin Fort, and so badly placed that its range is very limited, is an Armstrong B.L. 40-pr. gun, mounted in a very peculiar manner. At first sight nothing is visible but a wooden cover like that of a large well, but on examination it appears that beneath this is a pit, about 30 feet in depth, lined with stone and fitted at the bottom with extensive stores, &c. The gun, which is carried on a naval slide, stands on a platform; the latter is raised by counterweights when the gun is loaded, and after the fire has been delivered is wound down by a windlass, in order that the loading may take place under cover. The wooden roof runs on rails, so that it can be pushed away when the gun comes into action. Every part of the machine seems to be in excellent order, but it does not appear that the gun was in action on July 11. There are in the stores abundance of shells, both common and shrapnel.

The following table gives the total armament of the Ras-el-tin lines:—

Armament of Ras-el-tin Lines.

Positions.	M.L.R. Guns.				B.L. 40-pr.	S.B. Guns.			Mortars.				Total.
	10"	9"	8"	7"		15"	10"	6·5"	20"	13"	12"	11"	
A. Hospital Battery	2	...	...	...	...	...	...	...	...	2
B.	2	...	...	...	...	...	4
C.	2	...	...	...	...	...	2
D.	4	...	...	3	...	...	7
E.	1	...	...	...	...	...	1
F.	3	...	...	...	...	3
G. Centre Battery	1	2	...	...	...	...	...	...	...	...	...	...	3
H.	3	...	...	...	...	3
I.	2	...	...	...	...	2
J. Moncrieff Gun	1	...	...	...	...	...	...	...	...	...	...	1
K.	2	1	...	3
L.	2	...	...	...	1	...	...	3
M.	6	2	1	...	...	...	9
N. Left Battery	2	...	...	...	...	1	...	...	...	...	3
O.	2	...	...	...	...	...	...	2
Near Fort Ras-el-tin	1	...	...	...	...	...	...	...	1
	1	3	2	2	1	4	15	11	1	6	1	2	49
	8					30			10				

Fort Ras-el-tin.

The plan of this work has been adapted to its somewhat irregular site, but the western front, on which the fire of the fleet was principally directed, has a regular bastioned trace. The right bastion is cut off from the main work by a thick traverse, through which a passage affords an entrance to the battery.

The parapets are exceedingly weak, the average thickness being only about 15 feet, while those of the right bastion are 11 feet, and those of the left bastion about 8 feet only in thickness at the crest.

The scarp has a height of about 19 feet, and the crest a command over the sea of about 28 feet; the former is built of the same stone as the escarpments of the other forts, and appears, at least on the west front,

to have a remarkable thickness, since shells which have penetrated it for a distance of 10 or 11 feet have yet not reached the back of the revetment. The south-east front is probably intended only for a saluting battery, since it has but little defensive value.

The parapets do not appear to have been recently strengthened, but there was in the fort a considerable quantity of stone, lime, and sand, which had probably been collected with the object of adding to its strength; while in the right bastion an excavation has been made and a revetment commenced with the apparent object of thickening the right flank, which is at present a 9-foot wall.

The main magazine lies under the front parapet and is exceedingly well covered; it was quite uninjured, but the smaller magazine on the east side of the fort must have narrowly escaped the effects of the shell which destroyed the stores.

Armament of Fort Ras-el-tin.

Positions.	M.L.R. guns.			S.B. guns.			Mortars.		Total.
	10"	9"	8"	15"	10"	6·5"	13"	11"	
North Curtain ..	..	..	..	..	3	..	..	..	3
Right Bastion ..	..	2	..	..	..	..	1	..	3
West Curtain ...	..	..	..	2	2	..	..	2	6
Left Bastion ...	1	2	..	..	..	..	..	..	3
South-east Faces	..	..	1	..	..	21	..	..	22
	1	4	1	2	5	21	1	2	37
	6			28					

The rifled guns and two 6·5-inch S.B. guns (on the south-east face), fired through embrasures, the remainder were *en barbette*. All the guns were mounted on traversing platforms, with the exception of the nineteen 6·5-inch S.B. guns on the south-east faces, which probably merely formed a saluting battery.

Effects of the Bombardment.

The barracks to the north of the fort (which had no defensive value) are riddled with shell and are in many parts in ruins. Between these barracks and the fort communication is carried on by means of two covered ramps (marked E on plan).

The parapets of the fort on the west side are so scored with shell that it is difficult to count or to estimate the number of hits; but, thin as they are, they have at no point been pierced, though several shell, had they hit at more favourable spots, must have made their way through.

The scarp has also suffered severely both at the bastions and the curtain, and is on the right face of the right bastion much marked by

shrapnel bullets. On the west front the parapet shows about twenty-three hits and the scarp twenty-four.

The two S.B. stores (shaded) have been burnt and the rifled shell store is riddled with shell, which have, as a rule, passed through without bursting, owing to the little resistance offered by the very poor masonry.

The lighthouse, which stands in the centre of the fort, has unfortunately been hit by several shell.

The injury sustained by the armament has been entirely confined to the rifled guns, and is as follows:—

In the right bastion—

Right Gun (9-inch).—This gun, though the compressor is on, has run back to the end of the slide, and, breaking the ties, has tilted up on its breech with the muzzle in the air. It is unlikely that this accident was caused by the fire of the fleet, for the keep-pin of the holdfast is broken, and the whole system was evidently greatly strained.

Left Gun (9-inch).—Has been struck by two shell, of which one passed through the crest of the parapet to the left of the embrasure. The gun and carriage are both destroyed. The former has been hit on the left side on the trunnion ring, which 'is partially torn away; the carriage is in pieces, and the brackets have been torn off and broken. The gun has been thrown about 12 feet to the rear, and has crushed some of the detachment, whose bodies are still beneath it.

In the left bastion—

(i.) *10-inch M.L.R. Gun*.—Has been hit on the muzzle, but the tube is not damaged. The sockets of the running-up levers are broken by use, and, the tackle having been first shot away and replaced, the shot crane has been broken by a shell, and is useless.

(ii.) *9-inch M.L.R. Gun*.—This gun has run back and tilted up on the breech in the same manner as the 9-inch gun in the right bastion, but in this case the compressor was not on; the holdfast is not broken, but the keep-pin has carried away, and the bars have drawn off the pin.

It is doubtful whether this result was in any way caused by the fire of the fleet, for though the rear truck of the slide has been hit by a shell, a blow so placed would not be likely to have such an effect, while there is no sign of any other damage to the gun.

South-east face—

8-inch M.L.R. Gun.—This gun has been struck in reverse by shells which have passed over the 10-inch gun in the left bastion. The gun and carriage are capsized on the left side, but are uninjured; one truck of the slide has been cut away. The embrasure and parapet in front of the gun have been wrecked, and the gun is now resting on a mass of concrete, which formed the left cheek of the embrasure. This damage was probably caused by three or four successive shells.

On the above-mentioned block of concrete is the print of the head of a Nordenfelt bullet, depth $4\frac{1}{2}$ inches, and the cascable of the gun is also scored by a similar projectile.

It will be evident from the above that Fort Ras-el-tin has suffered

more severely from the bombardment than either Pharos or Adda, since of the rifled guns which could bear upon the fleet, there is not one which can be declared fit for service.

The resistance offered by this fort was probably more prolonged than that of the others, for the reason that it had not before it the example of surrender; again, the magazine was uninjured and safe, nor were there, as in Pharos, masses of useless masonry, whose crashing fall at the impact of every shell added tenfold force to the moral effect of the enemy's fire.

Fort Saleh Aga.

This small and unimportant work stands on the south side of the harbour, at a short distance to the south-west of Alexandria. It consists of an old and weak redoubt, containing a few guns, and some very cramped buildings for stores and barracks; to this has been, at a later date, added a battery of rather better construction, but of no real strength.

The armament consists of—

Four 10-inch S.B. guns, and

Eight 6·5-inch guns;

and the only injury inflicted during the bombardment has been the dismounting of one of the latter.

The fort stands at an elevation of about 60 feet above the sea; in rear of it there is a very large and well-built magazine, which appears to be entirely above ground.

Between Saleh Aga and Oom-el-Kubeba lies a small battery, which is armed with—

Two 10-inch S.B. guns.

Two 6·5-inch do.

Of these one 10-inch S.B. has been dismounted by a shell, which has cut off the right trunnion; while one of the 6·5-inch guns is destroyed though not dismounted, for the breech with the trunnions remains *in situ*, while the chase for a length of 4 feet from the muzzle is lying in *front* of the battery.

It is probable that the latter injury was the result of the bursting of the gun.

Oom-el-Kubeba.

This work, which is about a mile to the west of Saleh Aga, stands on a small hill, the greatest height of which above the sea is about 80 feet.

The sea-front of the work has a good profile, especially in the battery in which the rifled guns are mounted, but the landward faces are merely walls loopholed for musketry.

The entire fort is surrounded by a ditch, which has a revetted escarp and counterscarp, the height of each being about 10 feet on the sea faces; on the land side the counterscarp rises into a wall above the crest of the glacis, while the scarp forms a long curtain of which the crest has a relief of about 30 feet above the bottom of the ditch; the latter being about 15 feet in depth.

The entrance of the fort is on the east side, and is covered by a detached work of masonry. The main fort is divided into two parts by a traverse which extends entirely across it.

The first part is composed of five faces, and has some pretensions to strength, though the interior slope of the parapets is only about 5 feet in height, and there are no traverses.

The second portion of the fort has little defensive value, but is remarkable for the fact that the quarters and stores are all concealed in an excavation,¹ to which access is gained by a stair, while at a depth of about 50 feet below the terreplein are three large halls cut out of the live rock. These halls are partially filled with piles of old bar and chain shot. At the foot of the last stair is a well cut down through the rock, while a supply of water is brought, from what source is not known, into the upper part through a leaden pipe, which runs up the wall of the rear face.

The manner in which the ditch is (or was originally) used as the road into the fort, the means taken to flank it, and the character of the excavated cover, as well as the position of the fort, and the manner of the water supply, all recall very forcibly many of the Mahratta hill forts in the Western Ghauts of India.

The armament of this fort is as follows :—

Two 8-in. M.L.R. guns ;
Ten 6·5-inch guns ;
One 11-inch, and
One 13-inch mortar.

The effects of the bombardment as regards the works are considerable, but their magnitude is due less to the number of hits on the parapet (7) than to the size and weight of the 16-inch shell which caused the majority of the injuries. The effects of three of these shells from the 81-ton guns of the "Inflexible" are well worthy of note. One shell, having burst on the top of the scarp, has by its sole action made an almost practicable breach.

Two others have, within a few feet of each other, hit the parapet in front of the right 8-inch gun, and have almost pierced the 24-foot parapet. They appear to have struck the exterior slope about 4 feet below the exterior crest, and, having cut a trough in the parapet about 11 feet in width, have burst after penetrating 17 feet, and have formed craters 8 feet in radius, and 5 feet and 4 feet 6 inches in depth.

With regard to the ordnance, the only damage which has resulted from the action is the destruction of a 36-pr. S.B. gun. It is difficult to say whether this gun burst on discharge, or was broken by the impact of a heavy shell, but probably the latter was the case. The only parts which remain of it are—the breech, which lies about 30 yards in rear of its platform, and one trunnion with part of the chase, weighing in all about 4 cwt., which has blown a distance of 70 yards, and having just cleared a traverse, is embedded in a soft stone

¹ Marked H in plan.

wall, at a height of about 6 feet from the ground. The two 8-inch Armstrong guns were uninjured.

It is interesting to note that a 10-inch shell (blind) fired by one of the ships is lying in the centre of an arched passage of about 24 feet in length. It is quite impossible to guess how it comes to be in its present position, since the seaward entrance to the passage is covered at a distance of only 8 feet by a high traverse.

Fort Kamaria.

Of this redoubt there is little to say. It has a fairly strong profile, with a revetted scarp; in its trace it is a lunette, and is closed by a defensible barrack.

Its armament consisted of—

Two 10-inch guns S.B.
Four 36-pr. " "
One 13-inch mortar.

It was untouched by the fire of the fleet, and is believed not to have been engaged on the 11th of July.

Meks Sea Lines.

These lines, which commence about a quarter of a mile to the west of Kamaria, extend along the coast for a distance of 1,800 yards, their left flank resting on Fort Meks. The works form a continued line, which for the most part is a parapet for infantry, of about 12 feet in thickness, but at four points, marked A, B, C, and D, batteries are erected, of which the parapets are from 15 to 18 feet thick.

The scarp is not revetted, and the height of the interior crest does not exceed 4 feet 6 inches above the terreplein.

The guns are mounted on traversing platforms and fire over the parapet, there being no embrasures. The batteries are not provided with traverses.

The armament of the batteries is given in the following table:—

Positions.	S.B. guns.			Total.
	15"	10"	6·5"	
A Battery.....	..	7	3	10
B " 	2	..	..	2
C " .....	..	4	6	10
D " 	2	..	..	2
	4	11	9	24

In rear of A and C Batteries stand two stone towers, which serve as stores, magazines, and, being loopholed, if necessary as *réduits*. None of these batteries are much injured by the fire of the fleet, nor do they appear to have taken any very great part in the defence. A 10-inch gun in A Battery has, however, been dismounted by a shell.

Many other guns are at the present moment dismounted, but this would appear to have been done by hand after the bombardment, since these guns show no mark of any damage.

The general height of the line above the sea is about 15 feet, but some portions rise to 20 and 25 feet.

Meks Fort (Plan A).

This work, which has evidently been undergoing alterations, varies very much as to its defensive value in different parts.

(a.) The parapet in front of the 9-inch and 10-inch Armstrong guns is 6 feet 6 inches in height, and has a thickness of 35 feet.

(b.) That of the right half of the sea battery is about 5 feet in height, and has a thickness of 22 feet, while the low battery

(c.) That on the left flank is only 4 feet high and 17 feet thick.

The embrasures in (a) have a splay of 60° , and that of the 10-inch gun is countersloping. Whether it is intentionally so made it is difficult to decide, and possibly the real fact may be that the construction of even this part of the work is incomplete. In (b) there are nine very shallow embrasures of no great splay; only eight guns are, however, mounted in this portion of the fort. The guns at (c) fire *en barbette*.

The gorge of the fort is closed by a line of barracks and stores; these, with the detached stores and the upper magazine, are built of the same soft stone which is used for the other forts.

A second magazine lies underground, beneath the upper, which last is empty. The right flank of the work is closed by a wall, which is provided with a banquette for infantry.

The command of the crest of the parapet of (a) above the sea is about 22 feet, and the escarp along the sea-front is revetted to a height of about 13 feet. The escarp of (b) battery is not revetted, but slopes down to the sea.

The armament is as follows:—

Positions.	M.L.R. guns.			S.B. guns.		Mortars.		Total.
	10"	9"	8"	10"	6·5"	13"	11"	
Sea battery (a).....	1	1	..	..	..	..	..	2
" (b).....	..	..	3	2	3	3	2	13
Left flank battery (c) ..	..	..	..	2	2	..	..	4
	1	1	3	4	5	3	2	19
	5			9				

To the left of the 9-inch gun, and about 30 yards in front of the left flank battery (c), extends a wall about 16 feet high and 3 feet thick; in front of this again is a small fragment of wall, 6 feet in thickness.

Effects of the Bombardment.

The parapets of the fort are practically uninjured, but the buildings are almost swept away. The small store in front of the magazine is laid flat with the ground: a shell bursting inside has levelled the walls, which have fallen in one piece, like those of a house of cards. The large store is riddled with shot, but, strange to say, the magazine is untouched.

The barracks and stores in the rear of the fort are very much damaged: this is above all the case in the neighbourhood of the entrance, which is scarcely distinguishable, being blocked up with ruined wall.

The fort contains many fragments of shell: the loss of life among the defenders was probably considerable.

The damage sustained by the guns is as follows:—

10-inch M.L.R. Armstrong Gun.—The gun has been struck on the second coil by a shell which has cut a groove in the metal of an oval shape, 11 inches long, $6\frac{1}{2}$ wide, and 1 inch deep: the coil is shaken out of place, and cracked, but the gun is still serviceable.

A Nordenfelt bullet has hit this gun obliquely 18 inches in front of the trunnion, and has penetrated 1·25 inch, and a shell has also burst under the rear of the left trunnion, but has done no damage.

It is impossible to state, as regards either this or the succeeding gun, what injury was caused by the fire of the fleet to their carriages or platforms, since all have been entirely destroyed by the gun-cotton charges which were used by the landing party on July 11th, for the purpose of dismounting the guns.

9-inch M.L.R. Gun.—The gun has been struck by a shell on the right side of the breech, and has received an oval graze 12 inches in length, 7 inches in breadth, and 1·25 inch deep.

In the right portion of the sea battery the three guns on the left, a 10-inch S.B. and two 8-inch M.L.R. guns, have been hit by from nine to twelve shrapnel bullets, while the fifth gun from the left, an 8-inch Armstrong, has been struck on the second coil by a shell which seems to have come in over the parapet.

The blow has dismounted gun, carriage, and slide, and has thrown the first a distance of 3 yards. The metal of the gun is ripped off at the point hit for a length of 18 inches, and the trunnion ring is also started by the force of the blow. There is on the left of the breech the mark of a Nordenfelt bullet—depth ·55 inch.

The carriage and slide though upset are not damaged with the exception that the bars of the compressor are bent.

The remaining guns in this battery, 36-prs., are uninjured.

Left Flank Battery.—The action of these guns is worthy of note, for it was said by an eye-witness of the bombardment, who was on board of the “Invincible” on the 11th July, that they were much annoyed by the fire of two 10-inch S.B. guns, which appeared to be protected, either in a Moncrieff pit or in some other way, since it was found very difficult to silence them.

It appears not unlikely that *these* were the 10-inch guns in question,

and that their comparative safety was due to the existence in their front of the wall of which mention has been made, and which at the top is about 6 inches below the level of the crest of the parapet.

This wall, though sufficiently low to allow of the fire of the guns on the ships, was yet high enough to burst (it was too weak to stop) many shells which might otherwise have hit the battery, while those projectiles which cleared the wall for the most part flew over the guns. The shattered condition of the wall, and the fact that the battery was almost untouched, appear to have proved that this suggestion has in it some little truth.

The effects of the bombardment on the guns in the left flank battery are as follows:—

Left Gun (10-inch S.B.).—This gun has been hit on the right of the carriage by a splinter, and near it are lying many fragments of a 64-pr. common shell: it was uninjured.

No. 3 Gun (10-inch S.B.).—This has been hit by a shell on the muzzle, and the carriage has been struck by thirteen shrapnel bullets; both gun and carriage are undamaged. The two remaining guns in the battery are 6·5-inch S.B. guns; they are both untouched.

At the gate of the fort four 9-inch and one 10-inch M.L.R. guns lie on skids, while a second 10-inch Armstrong gun lies in front of the magazine. Inside of the fort are two 10-inch and eight 9-inch carriages and slides, while in the bastion to the west of the fort were four more 9-inch M.L.R. Armstrong guns.

Plan B.

On the 14th of August, 1882, a plan drawn by some Egyptian engineer was found in one of the arched exits from the Meks land lines.

This gives distinctly, as shown in Plan B, the trace of the proposed improvements which were to have been made in Fort Meks.

The parapet was to have been continued on the left up to the barracks, and on the right to the sea line, and was further to have been strengthened along the whole front. The terreplein was to have been protected by traverses containing expense magazines, and little doubt can exist but that the six M.L.R. guns which were lying in and near the fort would have been mounted at the new embrasures.

No one who examines the two plans can fail to see how very much these changes would have added to the defensive and offensive value of Meks Fort, which, as shown in Plan B, would have been in trace and armament the strongest of the Egyptian forts.

From one drawback this work must always have suffered—namely, the small elevation of its parapet above the level of the sea, but a few more weeks of labour would have made, of what was in fact a weak and broken line, a strong fort strongly armed.

Forts to the West of Meks.

Marsa-el-Kanat is a small fort of no defensive power, which stands about 3,000 yards to the west of Meks Fort.

Its armament consists of—

Two 10-inch S.B. guns.

Two 6·5 „ „

A few shells were, on the 11th of July, thrown at this work by the "Monarch," but no injury was done to the fort, though a shell exploded a small store of gun-cotton (intended for use in the quarries) which stood near it.

Fort Ajami is unfinished, and took no part in the defence.

Fort Marabout stands on an island about 3 miles from Meks Fort. It was attacked on the 11th of July by some of the gunboats, with the result that a small store has been burnt, while the scarp has received several hits, but none of the guns have been in any way injured.

The armament is—

Three 9-inch M.L.R. Armstrong guns.

Two 10-inch „ „ „	} Unmounted.
Two 9-inch „ „ „	
One 7-inch „ „ „	

Eight 10-inch S.B. guns.

Seventeen 6·5-inch S.B. guns.

Two 13-inch mortars.

Five 11-inch „

Meks Land Lines and Citadel.

The works which, commencing at Fort Meks on the north, run almost due south to within 300 yards of Lake Mariout may be styled the Meks land lines; they consist of a continued chain of bastions and curtains about 1,300 yards in length.

The lines have a good profile, a revetted escarp and counterscarp, and a wet ditch which communicates to the sea. Their relief is about 30 feet, and their command over the adjacent country about 15 feet.

The armament consists of a considerable number of guns, but since these lines were not included in the bombardment, details on the subject would be beyond the scope of this paper.

Two guns, however, which are mounted on the large bastion to the south-west of the citadel, are worthy of note.

The first of these is a gun of about 80 cwt., which is marked "Ruelle, 1833." This has been bored out by Armstrong, and, being lined with a steel tube, has now a calibre of 6 inches; the tube, which projects about a foot beyond the muzzle, has five grooves. The second was originally one of the 15-inch S.B. guns of which mention has been made before. It has also been bored out and lined by Armstrong, and has now a calibre of 8 inches, and four grooves.

The Citadel of Meks, or Fort Namusia, is an oblong masonry work, about 150 yards in length by 70 in breadth.

Its scarp has been cut down vertically from the foot of the walls through the live rock, in which is excavated a ditch, about 60 feet in width, and 30 in depth, with a vertical counterscarp.

The entrance is at the east end, and is accessible over a wooden bridge, of which part is a drawbridge.

This fort has little real power against modern artillery, and is mentioned only because from it the fire of some 40-pr. Armstrongs and 36-pr. S.B. gave some annoyance to the ships which were bombarding Fort Meks. It was found difficult to silence these guns, both on account of the distance of the fort from the sea, and also because since the ground rises to the south of Fort Meks the citadel stands about 60 feet above the shore.

Large numbers of torpedoes and torpedo-weights were found in this work and in the adjacent bastion.

I have endeavoured in the paper which I have just read to lay before you, as far as the time at our disposal will permit, the general effects of the bombardment of Alexandria, and I have, to the best of my ability, while so doing, avoided any expression of my own opinion upon any point, and also any attempt at deduction from the facts which I have had the honour to bring to your notice. I shall, however, hope, with the permission of the Council, to examine next Wednesday more particularly into the many points of the attack and defence which appear to promise interest or information.

I have to offer my most sincere thanks to Commander May, R.N., for his kindness in aiding me with the details of many important facts, of which, from my own knowledge, I could not have written.

I have also to thank Captain Clarke, R.E., with whom I worked at Alexandria, for the use of the drawings and notes which we made there, and must further acknowledge the kind assistance of Lieutenant-Colonel Tulloch.

Wednesday, February 21, 1883.

FIELD-MARSHAL H.R.H. THE DUKE OF CAMBRIDGE, K.G.,
G.C.B., &c., &c., &c., President of the Institution, in the Chair.

PART II.

YOUR ROYAL HIGHNESS, LADIES AND GENTLEMEN,

In the paper which I read last Friday I endeavoured to describe, with as much detail as the time at our disposal would permit, the effects of the fire of the fleet on each individual fort.

I now propose to examine into the character of the bombardment as a whole, with reference to both ships and forts, and to endeavour to bring to your notice such points in the attack and defence as appear to be most worthy of remark, and such failings in the works and armament of the Egyptians as are most replete with warning to all nations which need coast defences.

In order to avoid the constant repetition of apologies for venturing thus to put forward my opinions before an audience far better qualified

than myself to judge of the value of the details which I have given, I should wish once for all to say that, though, for the sake of brevity, my deductions may be presented in a manner which may appear didactic, I am in fact desirous only to offer for discussion such points as, at various times during the execution of my work, have attracted my notice, as being capable of affording interest or information.

General Action, &c., of the Fleet.

The inshore squadron, assisted by the "Temeraire," as was mentioned in my last paper, devoted its attention to Meks Fort and Lines. Of these the "Invincible" and the "Penelope" were anchored, while the "Monarch" was under way.

Concerning the action of this portion of the fleet there is little to observe, except to say that their work was most efficiently done; no one who visited Meks Fort after the bombardment could doubt but that the fire had been exceedingly severe, since, apart from the destruction of the stores and barracks, there was only one gun (if we omit the 6.5" guns which were probably not in action) which had not been hit by some missile.

The action of the larger ships which composed the outside squadron is full of interest to those who may be called upon to defend coast batteries.

In the many conversations which I have had at various times with Officers of the Navy on the subject of the attack of forts by a fleet, I have always been led to believe that the mode of attack in such a case would be as follows: The ships, formed in line ahead, would steam past the batteries, each ship delivering her fire as her guns in succession would bear. Having thus passed the line of defences, the ships would turn and repeat the process with the other broadside.

I have been given to understand that by this manœuvre the forts, which have the advantage of a fixed gun-carriage, would suffer from the disadvantage of a moving target.

On this principle for two and a-half hours (from 7 to 9.30) the bombardment of the forts, from Ras-el-tin to Pharos, appears to have been conducted by the "Alexandra," the "Superb," and the "Sultan."

Since at 9.30 this mode of attack was changed for one which consisted of the systematic concentration of fire on individual forts from ships more or less stationary, we may perhaps conclude that the former plan was found faulty.

I am further confirmed in my belief that the best principle in practice is the consecutive silencing of individual batteries, and not a general and, so to speak, collective bombardment, by the testimony of an eye-witness, who informed me that from the time of the adoption of the second plan the fire of the ships improved very much in accuracy.

From another source I received a corroboration of this fact, to which my informant further attributed a simultaneous diminution in the accuracy of the fire of the enemy, and I venture to say, under correction, but on good authority, that the majority of the shells which hit the "Superb," the "Alexandra," and the "Sultan" were

received by them before 9.30, that is to say, during the first two and a-half hours of the eight hours of action.

Probable Conduct of Future Bombardments.—From these statements I draw the conclusion that in future bombardments it is probable that ships will attack forts at a range beyond the armour-piercing power of ordinary projectiles, but from a more or less stationary position, and will thus abandon the advantage conferred upon them by their power to refuse a fixed target to their adversaries.

The ships will, however, of course, still possess, and make use of, every facility to change their posts whenever the forts may find their range.

But I would suggest that ships, by thus abandoning their former practice of engaging under way, not only surrender one of the principal advantages which they possess over forts with a fixed position, but further render themselves liable to suffer from vertical fire, which, if once accuracy of range can be obtained, must be most formidable, when directed against the small but comparatively weak targets which are offered by the decks of stationary ships. It would appear probable that, so long as ships are in motion, there is much chance that their fire, though severe, may not be decisive; it is therefore to the interest of the garrisons of the forts to keep them under way, and this object may be attained by directing upon them a bouquet of large shells as soon as they take up a stationary position. If this action were persistently and efficiently pursued, no ship could with impunity either anchor or remain motionless, except at an extreme range. Again, the nature of a contest between ships and forts is such, that any result short of a decisive success for the former, is a victory for the latter, and it is therefore necessary, as a condition of such success, that the fire of the fleet should be, not merely heavy, but overwhelming in its superiority.

May we not further reason, this being the case, and it being further found in practice that ships in motion cannot crush coast batteries, that forts which can by whatever means compel ships to keep under way, have *primâ facie* an advantage over the latter?

In other words, the benefit which is gained by the moving target is more than cancelled by the moving gun-carriage, and ships which intend to successfully engage forts must be content to become for a time mere floating batteries.

Result of the Fall of a Gun on Board Ship.—Another point, suggested by an Officer of the Navy, is, I think, worthy of our attention. We have seen how in Fort Ras-el-tin a 12-ton 9-inch gun was, by the burst of a shell, thrown from its carriage to a distance of 10 or 12 feet.

What would have been the result had this casualty occurred on board ship? It is of course unlikely that it should occur in the battery of an ironclad, since such an accident would probably imply that the shell had entered through the port. But no one can deny but that such a thing may happen,¹ and it is thus surely necessary to make some provision with regard to so important a matter.

¹ On the 11th of July a shell entered a port of the "Penelope" and put an 8-inch gun out of action.

It is probably not too much to conclude that a gun of such weight falling as it probably would from a height of 5 or 6 feet, would be almost certain to burst its way through the deck, and might not impossibly inflict such damage on the framework or skin of the ship, which is not constructed to resist a blow from the interior, as would result, if not in total loss, at any rate in retirement from the action.

Such an injury would be caused only by a large shell; the action of a small projectile would probably tend to blow away the brackets of the carriage, in which case the gun would fall on the slide with the minimum of damage. Examples of similar action may be observed in Meks Fort, where this result has followed the explosion under the gun of small charges of gun-cotton.

With the suggestion of these two points for discussion, I propose, since our time is limited, to pass from the question of the reciprocal action of ships and forts, and to return to the subject of the paper.

Character of the Fire of the Ships.—If we examine into the character of the fire of the outside squadron, we shall find that in direction it was remarkably accurate.

Of this the best proof is given by the comparison of the condition of the walls, buildings, &c., which lay immediately behind the guns which were in action, with other portions of the forts and batteries, which lay a short distance out of the line of fire. The centre battery in Ras-el-tin lines offers a good example of this statement, since the wall in rear is pierced through and through in the immediate neighbourhood of the work, and is almost uninjured throughout the remainder of its length.

But the elevation of the guns, as might be anticipated, was not so good, for appearances lead to the belief that the fire was in general too high; in proof of this fact may be mentioned the number of hits on the Pharos keep, and on the lighthouse at Fort Ras-el-tin, as also the fact that more shells have fallen on the buildings of the forts after passing over the parapets, than have struck the parapets themselves or the scarps.

Speaking roughly of the shot which have hit the forts, 50 per cent. have passed over the parapet, 33 per cent. have struck the escarp, and about 17 per cent. the parapet.

For this effect there may have been several causes; first, the extreme difficulty, on account of smoke and mist, which was experienced in seeing the guns or embrasures; second, the natural tendency to fire at conspicuous objects such as towers or flagstuffs; and, third, the inclination, which always shows itself in hurried firing, to take too full a sight.

To these may be added the apparently great effect of shells, which, falling on masonry, sent up a cloud of dust, as compared with that of such projectiles as cut their way through the crest without a sign: since thus the visible result of a shot, which was in truth by no means deadly, may have led to the retention of the elevation with which that shot was fired in preference to that of one which had produced no obvious effect.

From a careful examination of the parapets, I am led to believe

that the most effective shots were probably those least likely to attract observation.

Blind Shell.—With regard to the number of blind shells, as to which there has been some discussion, the number seen on the entire line may be roughly estimated at about 50; of these about 66 per cent. were Palliser and 33 per cent. common shell. No blind shrapnel were observed. The small resistance offered by the bad masonry and by the yielding sand may possibly account for some of these failures:¹ in other cases the point of the shell, and with it the fuze, has been as it were ground off on impact; and a few fuzes seem to have blown without igniting the charge.

In the west ditch of Pharos lie two 10-inch common shell, of which the appearance is most remarkable: they have broken transversely across; the base of each is still full of powder, while the serge of the bag is almost white; facts which prove conclusively that the fractures are not the result of explosion.

To account for this condition of the shells, I would suggest that, the axis of each projectile having been during flight inclined to the horizon, it has, in falling, struck an angle of the masonry, not with its point but with its side, and has thus been broken transversely.

Machine-Guns.—A few words must be said as to the action of the machine-guns (Gatling and Nordenfelt), of the effect of which much mention was made in the newspapers. It having been stated that in many cases the gun detachments had been driven from their guns by the fire of the above weapons, especial care was taken to examine every piece of ordnance in the defences for the marks of such fire, on the principle that, if the gunners were hit, the gun itself could certainly not escape untouched.

With regard to the Gatling guns (which fired during the action 7,100 rounds), it will be sufficient to say that, after a most careful search in all the forts and batteries, no sign whatever could be found of their effect.

Of the shot of the Nordenfelt guns (which fired 16,233 rounds) 5 marks were found.

These were as follows:—

(i.) A deep (4·5") print of the head of a shot on a concrete block, which had fallen from the embrasure of the 8-inch M.L.R. gun in Fort Ras-el-tin.

(ii.) A mark on the cascable of the above gun.

(iii.) A dent on the left bracket of the Moncrieff gun.

(iv.) An oblique hit, 1·25 inches in depth, on the 10-inch M.L.R. gun in Meks Fort.

(v.) A hit, ·55 inch in depth, on that 8-inch M.L.R. gun in Fort Meks which was dismounted by a shell.

There were no visible marks of projectiles from either of these weapons on any of the scarps or parapets, but it was reported that a

¹ The percussion fuzes used during the bombardment were, as was customary for sea service, designedly constructed in such a manner that they were not liable to act on graze, but only on direct impact.

considerable number of Nordenfelt bullets were picked up in Fort Meks.

The effects of shrapnel were far more frequent and more marked than those of either of the machine-guns.

The Hits received, the Losses suffered, and the Ammunition expended by the Fleet.

Hits.—The hits received by the fleet during the bombardment were as follows :—

“*Alexandra.*”—24 shot and shell penetrated the ship above the armour-plating; among other injuries the cabins of the Admiral, the Captain, the Commander, the Staff-Commander, and the Torpedo-Lieutenant were all damaged.

Several shot and shell struck the armour; of these one, which fell on the upper edge, made indentations on the plate of from $\cdot 5$ inch to 1 inch in depth.

The foremost funnel was hit in 3 places, the standing rigging in 8, and the running rigging in 21 places.

The total number of hits was thus about 60.

The losses were 1 killed and 3 wounded.

“*Sultan.*”—The number of hits is not exactly detailed, but is reported to have been about 27, of which 2 struck the armour, denting 2 plates and starting 1.

The holes made in the side were as follows :—

(a.) 16 inches by 12 inches; (b.) 15 inches in diameter; (c.) 14 inches in diameter.

The rigging was cut in several places, and a hole 16 inches by 10 inches made through the mainmast.

The losses were 2 killed and 8 wounded.

“*Superb.*”—14 hits, of which 7 were on the hull, and 7 on the upper works and spars.

A 10-inch shell struck the port-side, and, bursting, tore a hole in the side 10 feet by 4 feet, within 3 feet of the water-line.

The armour-plates on the port side were struck with 2 shells, of which—

(i.) Indented the armour 3 inches, while

(ii.) Burst, starting the plate and breaking 14 rivet heads.

Some of the standing and running rigging was shot away, and a hole 12 inches in diameter was made in the foremast.

Two other holes in the side were as follows :—

(a.) 10 inches in diameter, 4 feet above water-line.

(b.) 12 inches in diameter (10-inch shot), 5 feet above water-line.

The losses were 1 killed and 1 wounded.

“*Penelope.*”—Received 8 hits, of which 3 were on the armour; these left little or no indentation. Of the others—

(i.) Passed through the after embrasure, starboard side, but did no special damage.

(ii.) Hit the starboard quarter gallery.

(iii.) Struck the starboard gangway, hit a 9-pr. gun, carried off the sight and damaged the carriage.

(iv.) Hit the mainyard, port side.

(v.) Struck the muzzle of one of the 8-inch guns, stripped the B-tube for 6 inches off the A-tube, then broke up and destroyed the transom plate of the carriage. The gun and carriage were put out of action, and 8¹ (or 10) men were wounded. Some of the rigging was shot away.

The losses were 8 (or 10) men wounded.

"*Invincible*."—The exact number of hits is not given in the report, but it appears to have been about 11, 6 of which passed through the side.

A large dent was made in the armour by a shot, which also started the plate.

The losses were 6 wounded.

"*Inflexible*."—No definite return can be obtained of the hits on this ship. Their number is reported to have been 6, but of their effect nothing can be stated beyond the fact, "that the armour-plating was not struck, and that such projectiles as took effect struck or exploded outside the citadel."²

"No serious injury was done, though the upper works were a good deal knocked about."³

The losses were 1 killed and 2 wounded.

"*Monarch*" and "*Temeraire*."—Received no hits and suffered no losses.

The gunboats appear to have also entirely escaped injury.

Losses.

Table of Losses.

Ship.	Killed.	Wounded.	Total.
"Alexandra"	1	3	4
"Superb"	1	1	2
"Sultan"	2	8	10
"Inflexible"	1	2	3
"Invincible" .....	..	6	6
"Penelope" .....	..	8	8
Total.....	5	28	33

Expenditure of Ammunition.—The expenditure of ammunition by the Fleet is given in the following tables, which are compiled from the official report:—

¹ The report of the Captain of the "Penelope" states that 10 men were wounded by this shot, but the General Return gives only 8 names.

² Report of Captain, August 7, 1882.

³ Admiral's despatch, July 20, 1882.

Expenditure of Ammunition.—Filled Cartridges.

Ship.	Gun.																		Total lbs.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
	16"	12"	11"		10"		9"		8"		7"		64-pr.		40-pr.	20-pr.	9-pr.	7-pr.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
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Ship.	Gun.						Total heavy Guns.	Gun.				Grand Total.	Martini- Henry.	Norden- felt.	Gatlings	Rockets.
	16"	12"	11"	10"	9"	8"	7"	64-pr.	40-pr.	20-pr.	9-pr.	7-pr.				
"Alexandra"	48	221	..	..	..	..	..	138	..	..	..	4,000	340	..
"Sultan"...	137	50	..	..	..	..	139	..	12	..	1,800	2,000	..
"Superb"	310	..	..	..	..	..	60	41	..	..	1,161	880	..
"Penelope"	231	..	..	96	23	30	..	5,000	1,672	..	..
2 "Monarch"	117	..	..	48	..	21	..	..	..	153	28	1,800	3,440	2,680	21
2 "Temeraire"	136	84	..	..	..	..	..	8	..	..	..	160	..	..
"Invincible"	126	..	..	106	..	18	..	..	2,000	2,000	1,000	..
"Inflexible" ..	88	..	..	..	..	..	..	..	..	120	..	..	..	2,000	..	..
"Beacon"	16	22	..	53	..	10	320	..	..	3
"Condor"	65	128	..	..	..	8	1,000	..	200	13
"Bittern"	33	..	56	..	..	..	..	..	..	..
"Cygnets"	101	..	42	..	..	..	..	..	..
"Decoy"	49	..	20	..	..	40	..	..	..
"Helicon"	6	..	..	..	..	..	..	..	..
Total ...	88	117	184	752	224	231	135	412	152	621	224	58	10,160	16,233	7,100	37
								1,731					8,198			

Character of Projectiles Fired.

Ship.	Filled Shell.				Empty Shell.	Shot.	Case.	Total.
	Common.	Palliser.	Shrapnel.	Segment.				
"Alexandra"	379	23	1	..	..	4	..	407
"Sultan"	247	24	3	44	10	10	..	338
"Superb"	257	83	25	34	..	12	..	411
"Penelope"	241	..	45	32	..	62	..	380
"Monarch"	227	5	129	..	..	6	..	367
"Temeraire"	139	70	13	6	..	..	..	228
"Invincible"	221	..	25	..	2	2	..	250
"Inflexible"	139	21	11	37	..	..	..	208
"Beacon"	21	..	..	1	61	18	..	101
"Condor"	162	..	8	..	31	..	..	201
"Bittern"	66	7	1	..	..	12	3	89
"Cygnet"	72	..	..	..	71	..	..	143
"Decoy"	69	..	..	..	..	..	..	69
"Helicon"	6	..	..	..	..	..	..	6
Total	2,246 or 70 per cent.	233 or 7 per cent.	261 or 8 per cent.	154 or 5 per cent.	175 or 5·5 per cent.	126 or 4·5 per cent.	3	3,198

Average Number of Rounds per Heavy Gun.

Ship.	Gun.							General Average.
	16"	12"	11"	10"	9"	8"	7"	
"Alexandra" .....	..	..	24	22·1	..	..	..	22·4
"Sultan" .....	..	..	..	17·12	12·5	..	..	15·5
"Superb" .....	..	..	..	19·37	..	..	..	19·3
"Penelope" .....	..	..	..	..	..	28·8	..	28·8
"Monarch" .....	..	29·25	..	..	24	..	21	26·57
"Temeraire" .....	..	..	34	21	..	..	..	27·5
"Invincible" .....	..	..	..	..	12·6	..	..	12·6
"Inflexible"	22	..	..	..	..	..	..	22
General average..	22	29·25	30·06	19·79	14	28·8	21	20·6

The General Character and Defects of the Egyptian Defences, &c.

The forts and batteries of the coast-line of Alexandria may be divided into three classes, viz.:—

I. *Modern works*.—These include—

Sea Battery of Pharos.

A Battery of Adda.

Centre Battery—Ras-el-tin Lines.

II. *Obsolete works*.—Including—

Remainder of Pharos.

Remainder of Adda.

West Battery—Ras-el-tin Lines.

Ras-el-tin Fort.

Oom-el-Kubeba.

Meks Sea Lines.

III. *Unfinished works*.—Such as—

Hospital Battery—Ras-el-tin Lines.

Meks Fort.

I. *Modern Works*.—These were both in trace and in profile of considerable strength, and have consequently sustained little damage. The value of the Pharos Battery was, however, much diminished by the distance from it at which stood the magazine; while A Battery in Adda owed its defeat to the faulty construction and position of the same adjunct. The Centre battery of Ras-el-tin Lines must, in any case, have soon ceased firing on account of the defective pivots of the guns.

II. *Obsolete Works*.—None of these defences were provided with traverses, if we except the left bastion of Ras-el-tin Fort, which was, in consequence, very cramped. The stores and barracks were in all the forts exposed and weak: there was in fact no bomb-proof cover along the whole line. The parapets of most of the batteries of this class were very weak, and in many cases too low also. No effort was in any case made to deflade any portion of the work with traverses or parados, and the magazines were rarely in security, while many portions of the line could be enfiladed from points on which no gun could bear.

III. *Unfinished Works*.—As such these are beyond criticism, but it appears probable that had time permitted the completion of these batteries, they would have equalled, if they did not surpass, in strength those of Class I.

One great error in the character of these defences is worthy of notice, namely, that of all the forts, no two could support each other, while each was individually weak in armament, if not in defensive power.

Thus Pharos with six rifled guns could not bring one of them to bear on a ship which lay west of Adda, and the latter, on the other hand, from which Pharos bears north-east, had the muzzles of three of its four large rifled guns pointed due west. How could either of these forts contend singly with such odds as three ironclad ships armed with twenty-eight rifled guns?

The same may be observed along the whole line, with the possible exception of Fort Ras-el-tin, the West and the Centre battery of Ras-el-tin; and as the result of this exception we find that the two ships which attacked this portion, the "Alexandra" and the "Sultan,"

received between them a number of hits exceeding the total of the whole of the remainder of the squadron.

The main faults of the Egyptian defence may be summed up as follows :—

1. The forts and batteries were unable to support each other.
2. There were too few traverses, and no paradoss.
3. There was no bombproof cover.
4. The parapets were often weak, and not of sufficient height.
5. The revetments of the cheeks of the embrasures and of the interior slopes, being of stone, frequently blocked the trucks of the platforms, and must have caused numerous casualties.
6. The stores were all exposed to fire, and the magazines were small and inconveniently placed even when they were in some degree safe.
7. The pivots of the guns were faulty in design, and bad in construction.
8. There was by far too small a stock of ammunition in readiness, and sufficient means were not available to ensure the supply of more during the action.
9. Many of the S.B. guns should not have been fought, but the detachments available for them should have been utilized as reliefs for the M.L.R. guns.

It is naturally difficult to arrive at any certainty with regard to the loss of the Egyptians in killed and wounded. They, themselves, place it at 280, while the Officers of the Navy estimate it at about 500. From what I have seen I should feel inclined to believe that the former number might represent the total of those who fell in the batteries, while the latter might include the losses of the infantry who are said to have been drawn up in rear of the forts. The number of men working at the guns did not probably exceed 2,000; it is said, on good authority, that these gunners were for the most part Nubians, and were the best troops in the Egyptian Army.

Effect of the Fire of the Fleet on the Ordnance of the Forts.

The total number of pieces which were dismounted on the 11th of July was—

Four M.L.R. guns;

Sixteen S.B. guns;

One mortar;

and it is proposed to examine into the conditions under which these casualties arose.

M.L.R. Guns Dismounted.—Rifled guns. These were—

(i.) An 8-inch gun in West Battery, Ras-el-tin Lines.

(ii.) A 9-inch gun in Right Bastion, Ras-el-tin Fort.

(iii.) An 8-inch gun, south-east face, Ras-el-tin Fort.

(iv.) An 8-inch gun, Meks Fort.

(i.) The 8-inch gun in the West Battery was struck on the breast of the carriage by a shell which entered the battery through the embrasure.

This is a casualty which must always remain possible so long as embrasures are used, and are not provided with iron shields; but it is

open to doubt whether in the case of the Egyptian forts there was not, as a rule, too large a space (sometimes as much as 2 feet) between the sill of the embrasure and the muzzle of the gun.¹

(ii.) The 9-inch gun in the right bastion of Ras-el-tin-Fort.

The parapet in front of this gun is 8 feet high, of which height 7 feet only are revetted, a fact which as regards the effect of shell practically reduces the available cover to the smaller dimension. The shell has cut away the crest for a depth of about 2 feet, and has struck the gun on the trunnion coil rather below the axis of the piece. The burst has flung the gun from its position, and broken up the carriage.

This casualty is, I think, due almost entirely to the little cover which was given by the parapet; had the latter been 2 feet higher the gun would probably have escaped, though the detachment would certainly have suffered from the splinters of the revetment.

(iii.) The 8-inch gun, south-east face of Ras-el-tin Fort.

Since the destruction of this gun was an accident, it having been dismounted by shell which were intended for the 10-inch gun, there is little to notice beyond the absolute necessity for the construction for a parados in all cases where guns may under any circumstances be exposed to reverse fire. The casualty is, however, an excellent proof of the accuracy of the fire of the fleet, since three if not four shells have fallen within a space 10 feet square.

(iv.) An 8-inch gun, Meks Fort. This gun has been dismounted in a similar manner to (i), with this difference, that the parapet being even lower (only about 5 feet) the shell has not touched the crest. The embrasure was indeed so shallow that the gun was practically mounted *en barbette*.

It is worthy of note that in only two of these four cases (viz., ii and iv) was the gun itself injured, while the carriage was injured in three cases (i, ii, and iv), and the slide, more or less, in all.

I would further draw your attention to the fact that casualties (i,) (ii,) and (iv) occurred in batteries which were not provided with traverses of any kind, while (iii) was, as has been before mentioned, practically accidental.

S.B. Guns Dismounted.—Smooth-bore guns. These were as follows:—

(a.) Four 6·5-inch guns in the casemates, Fort Pharos.

These casualties were the natural consequence of the accurate fire of heavy shell on casemates of inconsiderable thickness, and constructed of bad material.

(b.) Two 6·5-inch guns on the rear face, Fort Pharos.

The dismounting of these guns was an accidental consequence of the fire directed on the west face.

(c.) One 10-inch gun on the west tower, Fort Pharos.

There is some reason to believe that this gun overturned on recoil, but personally I am inclined to think that it was dismounted by a 16-inch shell.

(d.) Two 10-inch guns in C Battery, Fort Adda.

¹ Shells have in various cases in the course of the bombardment struck the muzzle of a gun without causing any injury.

The right gun in this battery was certainly dismantled by a shell, but there is some doubt as to the left gun.

(e.) One 10-inch gun in B Battery, Fort Adda.

This gun was probably dismantled by fire.

(f.) One 10-inch gun in D Battery, Ras-el-tin Lines.

Probably dismantled by a shell.

(g.) One 6·5-inch gun in Saleh Aga.

This gun was certainly dismantled by fire; it is still loaded.

(h.) A 10-inch gun in the battery between Saleh Aga and Oom-el-Kubeba.

This gun was hit on the trunnion by a shell.

(i.) A 6·5-inch gun in the same battery.

This gun, which, strictly speaking, was not dismantled, since the breech and trunnions remained on the carriage, in all probability, burst since the chase for a length of 4 feet from the muzzle is lying *in front* of the battery.

(j.) A 6·5-inch gun in Oom-el-Kubeba.

It appears probable that this gun burst, since the only parts of it which remain are—the breech which lies about 30 yards in rear of the parapet, and a fragment weighing about 4 cwt., which is imbedded in a wall about 70 yards to the left rear of the original position of the gun.

(k.) A 10-inch gun, A Battery, Meks Sea Lines.

Perhaps dismantled by fire, but these batteries were disarmed about July 13th, by landing parties sent ashore for that purpose.

Of the above guns all except (a) and (e) were mounted *en barbette*.

It is exceedingly difficult to decide, in the absence of any visible hit, whether a gun may or may not have been dismantled by fire, and there is good reason to believe that, in addition to those overthrown by blue-jackets after the bombardment, many of the guns now dismantled, overturned in consequence of the united effects of increased charges and extreme elevation used by the Egyptians in their endeavours to obtain greater range.

Guns, not Dismounted but otherwise Unserviceable.—Of these, among the M.L.R. guns, there were certainly six, and others might possibly be added.

(i.) The 10-inch gun, Fort Pharos.

Blocked by the ruins of the revetment.

(ii.) The 10-inch gun, Fort Adda.

This gun is off the racers.

(iii and iv.) The two 7-inch guns in the Hospital Battery, Ras-el-tin Lines.

These are both blocked by the ruins of the revetment, and one is in addition off the racer.

(v.) The 9-inch gun in right bastion, Ras-el-tin Fort. Holdfast broken.

(vi.) The 9-inch gun in left bastion, Ras-el-tin Fort. Keep-pin broken, and ties of the holdfast drawn.

In the cases of (i) and (ii) the holdfasts were damaged, as were also to a lesser degree those of all three guns in the centre battery, Ras-

el-tin Lines. Attention should also be directed to the almost universal damage, amounting in many cases to fracture, suffered by the sockets of the running-up levers of the M.L.R. guns.

With regard to the 13-inch mortar which is included among the dismantled ordnance, it is uncertain whether it burst or was struck by a shell. It stood in D Battery, Ras-el-tin Lines, and a large fragment, weighing perhaps 3 cwt., was carried thence to the left rear, over the Palace wall, and fell near the entrance gate, at a distance of about 250 yards from its original position.

The following table gives the amount of serviceable and un-serviceable ordnance at the termination of the bombardment:—

Effects of the Bombardment on Ordnance.

Fort or Battery.	Dismounted.			Otherwise Unserviceable.			Serviceable.			Total.		
	R.	S.B.	M.	R.	S.B.	M.	R.	S.B.	M.	R.	S.B.	M.
Fort Silsileh.....	..	..	..	..	..	..	2	3	1	2	3	1
Fort Pharos.....	..	7	..	1	4	..	7	26	4	8	37	4
Fort Adda.....	..	3	..	1	..	..	4	11	5	5	14	5
Ras-el-tin Lines....	1	1	1	2	..	..	6	29	9	9	30	10
Fort Ras-el-tin....	2	..	..	2	..	..	2	28	3	6	28	3
Fort Saleh Aga....	..	1	..	..	..	..	..	11	..	..	12	..
Battery.....	..	2	..	..	..	..	..	2	..	..	4	..
Fort Oom-el-Kubeba	..	1	..	..	..	..	2	15	2	2	16	2
Fort Kamaria.....	..	..	..	..	..	..	..	5	1	..	5	1
Meks Sea Lines....	..	1	..	..	..	..	..	23	..	..	24	..
Meks Fort.....	1	..	..	..	..	..	4	9	5	5	9	5
Total.....	4	16	1	6	4	..	27	162	30	37	182	31
	21			10			219			250		

Effects of the Bombardment on the Revetments of the Forts.

Any details which it may be possible to give on this subject must lose much of their value from the fact that during the bombardment no deliberate attempt was made to form practicable breaches in the revetments; rather, except in the instance of the casemates of Fort Pharos, the escarps were struck only by shells which had failed to reach their mark, the parapets above.

There was thus no careful placing of hits, and no systematic pursuit of a given object: the result, as might be expected, is that the various scarps are injured to a uniform extent in all parts, while in no case has a practicable breach been formed in one of the higher revetments.

Again, with a few exceptions, the guns used in the bombardment of Alexandria were not such as could be available for siege purposes, while the masonry of the forts was certainly of less than an average quality.

As examples of the action of the fire of the fleet on revetments, I produce the following elevations:—

(i.) The casemates on the left flank of the sea-front, Fort Pharos.

(ii.) The A Battery, Fort Adda.

(iii.) The bastioned front which forms the west face of Fort Ras-el-tin.

(i.) The following are the dimensions of the principal hits:

2. 14 feet high, 16 feet wide, probably several shells, of which one has pierced the casemate beyond the angle.

4 and 5. Probably three or four shells. The outer casing of the wall is demolished to a depth of 18 inches. The casemate is pierced and the gun wrecked.

7. A shell has penetrated and ruined both gun and carriage.

8 and 9. Probably bursts: outer casing of wall gone.

10. Two Palliser shells (10-inch) have pierced the casemate, and wrecked both gun and carriage.

11. Breach 12 feet wide and 9 feet deep, probably two or three shells.

13. Probably a burst—no injury done.

14. The wall is torn away, and the casemate pierced. The gun and carriage are utterly ruined.

15. The tower was pierced by a shell which burst inside.

(ii.) A Battery, Fort Adda.

1. Possibly a burst—no great penetration—two fragments of shell found beneath.

2, 3, and 4. Probably Palliser shells—did not burst—about 4 feet penetration.

5. Shell burst on cordon.

6 and 8. Similar to 2, 3, and 4.

7. Shell burst—penetration about 8 feet, but has not reached the back of the rubble wall. Gas-check found in the *débris*.

9. Probably four Palliser shells; all penetrated deeply, but did not burst; outer face of wall scaled off to a depth of 1 foot.

10 and 11. Single Palliser shells—blind. There were no traces of Gatling or Nordenfeldt bullets on this scarp, but the face of the wall was pitted with shrapnel, many bullets being found imbedded in the stone, while others had rebounded to the ground.

(iii.) Bastioned front, Fort Ras-el-tin.

1. Hit just above the cordon, penetrated the parapet, and burst.

2. The shell did not burst. Hole 3 feet 6 inches, 2 feet 6 inches wide, and 3 feet deep.

3. A similar hole. A 10-inch common shell (blind) lies 6 feet from the wall, with its point to the escarp. It probably rebounded, as the wooden fuze is knocked out.

4. Probably a Palliser shell—did not burst. Penetration over 8 feet.¹
5. Burst on the cordon. 7 feet 6 inches \times 4 feet.
6. Similar to 2.
7. A 10-inch common shell burst on the wall. Scaled off stone for an average depth of 1 foot over an area 7 feet 6 inches \times 4 feet; splinters of the shell found.
8. Two shells, which did not burst; great penetration.
9. Perhaps two hits, which brought down the angle for a depth of 14 feet below the cordon. A third shell has penetrated without bursting.
10. A single shell burst; diameter of crater about 6 feet; penetration 3 feet.
11. A similar hole; penetration 2 feet.
12. A practicable breach; the shell has pierced the scarp and burst; width of breach 10 feet.
13. Hole 9 feet \times 6 feet. Shell (blind) penetration over 8 feet.
14. Breach 18 feet wide. Two or more shells. Penetration, 6 feet.
15. Shell burst—8 feet \times 5 feet—depth 15 inches.
16. Diameter of hole 5 feet; penetration 3 feet 6 inches; shell burst.
17. 3 feet 6 inches penetration; under this point, at a distance of 8 feet from the wall, lies a 10-inch common shell. The fuze has apparently blown.
18. A breach about 12 feet \times 8 feet. Probably two shells; penetration great.
19. Hole 8 feet \times 4 feet 6 inches. The shell has run down into the ground without bursting. Near this point is a 64-pounder (blind) shell, about 10 feet from the wall.
20. Penetration 8 feet at the top; into the parapet; a good burst; breach 12 feet \times 6 feet.
21. Angle of scarp carried away to a depth of 12 feet 6 inches. Impossible to say how many shells.
22. Perhaps two shells; good burst; hole 15 feet \times 11 feet. Penetration 5 feet in centre.
23. Burst on the exterior slope; 9 feet of the cordon carried away.
24. Apparently the crater of a small shell; hole 4 feet 6 inches \times 4 feet, depth about 3 feet 6 inches.

Although from the above it would appear that there is some uncertainty as to the penetration of shell under apparently similar circumstances, yet we may, perhaps, form the following conclusions, and believe that they will, as a rule, hold true.

(a.) A large shell, on striking the wall, scaled off a portion about 5 feet in diameter.

(b.) If it were a Palliser shell, and blind, its penetration was generally at least over 8 feet.

¹ There were no means of measuring a greater depth than 8 feet.

(c.) In the case of a burst, the penetration rarely exceeded 3 feet 6 inches.

The base of the escarp was almost certainly thicker than the top, since a penetration of 5 feet at the cordon showed traces of earth, while at a depth of 8 feet, a shell which had pierced the lower part of the wall had not reached the back of the rubble masonry.

Some parts of this scarp were marked with shrapnel bullets, but there were no signs of the missiles of either Gatling or Nordenfolt guns.

Since, as was before mentioned, it was not an object with the fleet to make practicable breaches in the revetments, it will be scarcely necessary to further consider this section, and we may pass on to the more important considerations regarding the effect of projectiles on earthworks.

The Effects of the Bombardment on the Parapets of the Forts and Batteries.

Before proceeding to consider the general effect on the parapets of the fire of the fleet, it may be well to examine more particularly into the two cases of which plans are produced.

(i.) The bastioned front of Fort Ras-el-tin.

The hits shown on this are as follows :—

1. The neck of the embrasure of the 8-inch gun is ruined; the block of concrete which formed the left cheek, having been torn out, is now under the gun. This injury is the work of from two to four shells, which have passed over the 10-inch gun in the left bastion.

2. The face of the traverse is broken down, and the passage to the expense magazine blocked—one or two shells.

3. A burst at the end of a trough.¹ Length 18 feet, width 7 feet, depth 2 feet 6 inches.

4. The neck of the embrasure damaged by two shells, which both burst.

5. The trough of a blind shell. Length 7 feet, width 5 feet, depth 9 inches.

6 and 7. Probably the craters of small shell.

8. The scarp is broken down at the angle, to 14 feet below the cordon.²

9. Trough of a blind shell. Length 12 feet, width 4 feet, depth 2 feet 3 inches.

10. A similar trough, same dimensions.

11. A similar trough, depth 1 foot 6 inches.

12. A practicable breach, wall cut down 5 feet below the cordon.³

13. Trough and burst, width 12 feet; the interior slope is cut down nearly to the terreplein.

14. A large breach in the scarp,⁴ 13 feet by 15 feet, in consequence of which the parapet has fallen.

15. Trough of a blind shell, length 12 feet, width 4 feet, depth 1 foot.

¹ I on elevation.

² IX on elevation.

³ XII on elevation.

⁴ XIV on elevation.

16. Crater of a burst shell, 12 feet by 9 feet, depth 3 feet 3 inches.
17. The angle of the scarp is cut down to 6 feet 6 inches from the foot.¹
18. Splinters and small shell.
19. Neck of the embrasure destroyed; this was possibly the shell which dismounted the 9-inch gun.
20. Hit at the cordon.²
21. Trough and burst, length 10 feet, width 8 feet; the interior slope is cut down 4 feet from the crest.
22. A burst, length 10 feet, breadth 14 feet, scarp cut down 9 feet from the cordon.
23. Trough of a blind shell, length 13 feet, width 6 feet, depth 1 foot 6 inches.

If we analyze these hits, we shall find that they may be divided under four heads, as follows:—

- (i.) Hits on the scarp which have penetrated to the parapet; such are, for example, 3, 8, 12, 14, 17, 20, and 22.
- (ii.) Hits on the exterior slope, such as 6, 7, 9, 10, 11, 16, and 23.
- (iii.) Hits on the superior slope, such as 13 and 21, and perhaps 5 and 15.
- (iv.) Hits on the embrasures, as 4 and 19.

The 1st class we may dismiss without comment, since they are in no case likely to cause damage.

The hits on the exterior slope, which were in all the forts the most frequent, form almost invariably troughs, though in rare cases (as 16) the shells may burst.

Hits such as 13 and 21 are the most to be dreaded: such hits were rare, but only so because the superior slope was seldom struck.

The 4th class, hits on the embrasures, were not common, and unless when the shell struck near the neck not disastrous, except on account of the splinters which flew from the revetment.

(ii.) The sea-front of Oom-el-Kubeba.

The hits on this fort were exceptional in their character, being, as they were, for the most part the work of 16-inch shells. They were as follows:—

1. Counterscarp cut down 9 feet, an easy descent into the ditch, width 10 feet.
2. Counterscarp cut down 5 feet, width 7 feet.
3. Counterscarp cut down 6 feet, width 10 feet.
4. Scarp cut down 6 feet 6 inches, width 7 feet 6 inches; breach nearly practicable; the parapet has fallen in behind the scarp, probably at the point of the burst of the shell.
5. Scarp cut down 6 feet 6 inches, width 20 feet; accessible.
6. A small breach, scarp cut down 4 feet, width 4 feet.
7. Parapet cut down 3 feet below crest. Trough 16 feet long and 8 feet wide. This is the only case along the whole line of defences in which a shell, having struck on the exterior slope, has pierced the parapet and breached the interior slope; thickness of parapet 12 feet.
8. A crater of a burst shell, diameter 7 feet, depth 3 feet.

¹ XXI on elevation.

² XXXIII on elevation.

THE EFFECTS OF THE BOMBARDMENT OF

9. Shell has struck the superior slope; trough 8 feet long, 17 feet wide; parapet cut down to 1 foot above terreplein, probably a burst. It is possible that this shell knocked to pieces a 6·5-inch S.B. gun which stood at this point.

10. Crater of a small shell, diameter 2 feet 6 inches, depth 9 inches.

11. Shell has struck the superior slope; length of trough 13 feet, width 14 feet; parapet cut down to 1 foot 9 inches above terreplein; possibly a burst.

12. Trough and crater of 16-inch common shell; length of trough 25 feet; diameter of crater 15 feet, depth 4 feet 6 inches.

13. Trough and crater of 16-inch common shell; length of trough 26 feet; diameter of crater 16 feet, depth 5 feet. In this crater lay a splinter of the shell.

The character of the last two hits is similar in every way; the only difference between them is caused by the fact that 13 struck the exterior slope a little lower than 12, and has, therefore, cut away more of the parapet.

The interior slope was quite uninjured by their action, and the guns were absolutely untouched.

If we analyze the hits on this fort we find 1, 2, 3, 4, 5, and 6 were hits on the scarp and counterscarp, and may be passed over as without effect.

7, 8, 12, and 13 were hits on the exterior slope, of which 7 only pierced the parapet.

9 and 11 were hits on the superior slope, and being such were dangerous.

If we consider the great size and weight of the majority of the projectiles used against the forts of Alexandria, and further realize the velocity at which these masses of metal were travelling at the moment of impact, together with the capacity of the common shell and the consequent amount of their bursting charges,¹ we cannot, I think, fail to be astonished at the small effect that such powerful missiles have produced on the sand parapets, especially when we remember that the latter were, in many cases, according to modern theory, far too weak to afford any real protection. It is a fact, and one on which too much stress cannot be laid, that in only one instance was any one of the parapets pierced by a shell from the fleet.²

In some few cases, where a shell had fallen on the superior slope, it has breached the interior slope, and has torn away the revetment for an average width of 15 feet, and has thus done very considerable injury to the defenders by the shower of stones and splinters which it has thrown into the interior of the fort. But there is among all the forts and lines but a single example of a shell which, having struck the exterior slope, has succeeded in penetrating the parapet, or even by its burst, in shaking the revetment of the interior slope.

¹ The bursting charge of the 16-inch common shell is 60 lbs. of powder, and the shell when full weighs 1,700 lbs.

² No. 7 on sea-front of Oom-el-Kubeba. See *ante*.

The shells have, as a rule, cut troughs of greater or less depth in the parapets; at the end of these troughs one or other of three effects have been produced.

(i.) In cases where the shell has burst, a distinct crater is formed, which varies in depth and diameter in proportion to the size of the shell and its position at the time of bursting. Of this form of effect good examples are not common.

(ii.) When the shell has been blind, it has been found that the trough has gradually grown shallower, and at last abruptly ceased; from this fact I should wish to draw the conclusion that in such cases the shell has bored its way upwards through the parapet, and having escaped has passed on over the battery. Examples of this action are very common.

(iii.) Again, in other instances, the blind shell is found lying on the parapet at the end of its trough. In explanation of this fact, I should desire to suggest that, in all probability, in such cases the shell has not, after having pierced the parapet, sufficient velocity remaining to carry it on; it has thus first reared up on its base, and has finally fallen on the parapet. Such shells invariably lie with their heads towards the points from which they came.

The dimensions and character of some of the principal examples of the above action are given below.

Shell Troughs.

Fort Adda.—A well-marked trough, 16 feet in length, no crater, shell gone on.

Centre Battery, Ras-el-tin Lines.—Trough of a 10-inch Palliser shell, 12 feet long, 3 feet deep. Shell present, point reversed.

Magazine, Centre Battery.—Trough 15 feet long, 3 feet deep, no crater, shell gone on.

Fort Ras-el-tin.—Nos. 5, 9, 10, 11, 15, and 23.

Oom-el-Kubeba.—Nos. 12 and 13, and a similar hit at south-west corner of which the crater is 15 feet in diameter, and 4 feet 6 inches deep.

I beg to offer for discussion the following suggestions as to the cause of the above-mentioned action of shells which have struck the exterior slope of a parapet.

In the first place we may assume that one law governs all three cases, since in (i), had the shell not burst, it would probably have acted as in (ii) or (iii), while these last differ from each other only with respect to the velocity of the two projectiles.

Secondly, it will be allowed that at the moment of impact on the exterior slope, the shell is falling, and that its course, therefore, makes an angle with the horizontal plane. This angle is in the plate assumed to be 6° .

Thirdly, the shell, owing to the elevation of the gun from which it was discharged, is itself inclined at an angle to the horizon in such a manner that its point is higher than its base. This angle is in the plate assumed to be 3° . We have thus a projectile of which the axis is inclined at 3° , and which is falling at an angle of 6° .

It is obvious that a shell so moving cannot strike the exterior slope with its point; rather, so to speak, it crashes through it, and does not pierce it.

Having entered the parapet, the shell, which is now moving in a medium offering far more resistance than did the air, has a constantly increasing tendency to change its original direction for a course in prolongation of its axis, since thus it will encounter the least possible resistance.

Again, since in the cases observed the shell had cut a trough and not a tunnel in the parapet, the pressure will be greater on the lower than on the upper side of the head; for the earth below stands firm while the earth above gives way.

The shell, therefore, advances on a curve, the shape of which depends upon the combined effect of its velocity, its weight, the shape of its head, and the character of the resisting medium in which it is moving, but in all cases tending to bring the projectile to the surface of the parapet. On escaping from the sand, the shell, if it has sufficient velocity remaining, flies on, but if that velocity be exhausted, falls at the end of its trough.

The lower the velocity of the projectile at the moment of impact, the sooner will the tendency to rise act upon it,¹ while the larger the amount of parapet which a projectile has to pierce, the longer will be the time during which this tendency will act; in many cases, therefore, when the shell, from either of these causes, can but just reach the surface, it probably issues almost vertically from the sand. It would thus, on coming into the air, overbalance into the trough which it has itself cut, and would so lie with its head pointing towards the point from which it came.

If this explanation of the behaviour of shells be accurate, we should expect to find that, in fact, they do rise in their course, and such is, indeed, the case, as may be seen by the following examples:—

(i.) No. 7 hit, Fort Oom-el-Kubeba. The shot has risen about 3 feet 6 inches during its passage through the parapet, in a distance of 17 feet.

(ii.) The bottom of the crater of No. 12 hit in the same fort is about 6 inches above the point of impact of the shell, which passed through about 16 feet 6 inches of the parapet before bursting.

(iii.) No. 11 in Fort Ras-el-tin rose about 2 feet 6 inches in its course of 12 feet.

(iv.) No. 23, in the same fort, rose about 3 feet while passing through 13 feet of parapet.

Be the cause of this action what it may, the fact remains that under present conditions even heavy guns will fail, at a mean range of 2,500 yards, to penetrate a 24-foot parapet; and this is the case, not because modern shells are wanting in weight or velocity, but because while traversing a parapet they are forced into a false direction.

What remedy may be available to cure this defect of modern guns,

¹ It has, however, been proved in practice that a shell moving with a high velocity has a greater tendency to rise in a parapet than has a projectile of which the velocity is low.

I am unable to say, but I venture to draw the conclusion from what has been observed, that the conditions of successful fire against armour-plates and against sand parapets are very different in their nature.

Should, however, the shell fall on the superior slope, it will almost certainly pierce what remains of the parapet, and will tear away some yards of the interior slope.

As a protection against this danger I beg to offer for discussion a proposition to heighten the exterior slope, and to make the superior slope countersloping.

The time at our disposal will not permit me to enter into a full consideration of this question, but I base my suggestion on the broad ground, that it is wise to increase the extent of the exterior slope, on which a shell may strike with comparative impunity to the defenders, at the expense of the superior slope, on which almost every blow is deadly, and I would also urge that by the proposed form of parapet a greater thickness of earth is opposed to the action of high-angle fire, while the vulnerable superior slope is altogether concealed from the view of the enemy.

Some Points which require Attention in the Construction and Armament of Coast Batteries.

The following points, deduced from the foregoing statements with regard to the effects of the bombardment of the forts of Alexandria, are offered for your consideration as being of importance with reference to the choice of site, the details of fortification, and the provision of armament for coast batteries.

1. *It is of importance that batteries for coast defence should have a considerable command above the sea; but should not be conspicuous objects on the coast.*

No one probably will dispute this statement, for it is easy to realize that a fort standing 80 feet above the sea has greater powers of offence and defence against a fleet than has one which has an elevation of 40 feet, while the latter again is less vulnerable and more powerful than a battery *à fleur d'eau*. The real difficulty of the case lies in giving considerable elevation to a battery without making it conspicuous. But in practice what is required is not that the whole fort shall be invisible, but that the positions of the guns shall not be marked in such a manner as to render them visible at long ranges.

The Egyptian parapets and escarps were of the same colour, being covered with the same grey cement, and we have all heard of the difficulty which was experienced in seeing the guns.

On the other hand the casemates at Pharos, where the black embrasures showed distinctly against the white stone, suffered very much from fire.

From this it follows that whatever may be the material of the, so to speak, pedestal of a coast battery, the actual parapet which covers the guns should not be easily distinguishable from whatever background may be behind it.

Without mentioning names it may be said that many of our

batteries are very deficient in invisibility, and it may even be open to question whether casemates or stone forts are not, if only on this account, less desirable as defences than earth or sand batteries.

2. *The forts or batteries should not be small in size; or if small several must be built to support each other.*

If we take the average number of guns per ship in the fleet which bombarded Alexandria, we shall find that it is ten.

A fort which is armed with ten armour-piercing guns is certainly not a small fort, while it is almost certain that each fort in a system of coast defence must be prepared for action against more than one ship.

No hard and fast rule on the subject can be laid down, but the principle which I have suggested appears to be a true one.

3. *It is of less importance that coast defences be good forts than that they be good batteries.*

By this I mean that all care and money must be devoted to the sea-face, and that it is not of great importance whether the gorge be closed or not, since during a bombardment any parapet or wall used for that purpose will almost certainly be destroyed, while an attempt at a landing by the enemy is unlikely until after the guns had been silenced, and the value of the fort is gone.

4. *Great care must be taken to render the magazines and stores absolutely secure, and also to provide bombproof cover for the garrison.*

The first part of this statement needs no comment, but I would add to it a rider, that the use of several small stores and magazines is both more safe and more convenient for the service of the guns, than is that of one or two large buildings.

Bombproof cover is absolutely necessary for the protection of the wounded, &c., as well as for the shelter of the reliefs of the gun detachments, for infantry, &c.

5. *Some description of counter-guard should be made in front of all low-lying batteries, both for the purpose of deceiving the enemy as to the position of the true parapet, and of covering the latter from some proportion of the fire.*

In speaking of such a counter-guard, I have in my mind the effect produced, as I believe, by the wall in front of the left flank battery in Meks Fort.

Since it will probably never be necessary to fire the guns of the main battery with depression, the level of the top of the counterguard may be at least the same as that of the sill of the embrasure. Its distance from the main parapet should be such that no splinters would be likely to fly over the intervening space, while its solidity should be sufficient to hold or to burst every shell which strikes it.

6. *The parapet of a coast battery should be certainly 10 feet high, of which 9 feet should be revetted.*

It is absolutely necessary that the rear of the gun portion should be enfiladed at least from the bullets of shrapnel and machine-guns.

Less than 10 feet of parapet will not afford such cover, for given that the bullets fall at an angle of 10° , about $\frac{1}{6}$, such a parapet yields only 6 feet 8 inches of cover, at a distance of 20 feet from the crest.

The number who lays the gun must under the present system be always exposed to fire, though he can find some cover behind the breech.

No mention has been made of defilade from the fire of heavy shell, since it would appear from the results at Alexandria, that such a missile, if it strikes the superior slope within 6 or 8 feet of the crest, must shear away any parapet or revetment.

Fortunately it would seem that such hits are as rare as they are as destructive in their effect.

7. *Each gun should be divided from its neighbour by a bombproof traverse, and a parados should be provided in rear of each battery, in order that the remainder of the fort may be sheltered from fire.*

8. *Embrasures should be so constructed as to afford the worst possible mark for fire or sight.*

Since, if suggestion No. 7 be carried out, but few guns can be mounted in proportion to the length of a parapet, it is absolutely necessary that considerable splay be given to the embrasures, in order that as many guns as possible may be able to bear on the same point; again, if the parapets are high, the embrasures must be deep; for these two reasons they must be more or less conspicuous and vulnerable.

The weakening of the parapet, which is caused by the existence of embrasures, is a disadvantage attending their use which cannot be remedied, and woe to him who attempts to do so by revetting the cheeks with masonry. But embrasures can be, to a certain extent, disguised, if care be taken that they are marked by no conspicuous masonry, or by any distinct features of a colour strongly contrasted with that of the parapet.

Again, since it is unlikely that, except under peculiar circumstances of site, it will ever be necessary to fire heavy guns with depression, is there any reason why the soles of the embrasures should not be made horizontal, or even in some cases countersloping? In this manner both the apparent and the real depth of the embrasure may be diminished.

9. *Some provision must be made for resistance to an attack by boats.* Against such an assault, which would probably take place by night, precautions may be taken by placing Gatling, Nordenfelt, or S.B. guns, in positions whence they would be available for close defence, though not exposed to the fire of the fleet. It is unlikely that during the bombardment the ships would fire on these, since, not being in action, no indication would be given of their presence; while, except through the reports of spies, their very existence need not be suspected.

Again, the machine-guns might be placed under cover during the day, and be brought into position at nightfall, at which time, also, the artillery of the defence should hand over the care of the fort or battery to the infantry of the garrison.

10. *Mantlets of some description should be used to provide against the effects of shrapnel shells.*

11. *No revetments which can by any possibility be exposed to fire should be constructed of stone or brick.*

The Egyptians state that their principal losses were caused by splinters from the revetments, and the appearance of their batteries fully bears out the statement. No revetment is strong enough to keep out heavy shell, it serves only, if massive, to increase their effect. From this it follows that revetments for coast batteries should be used only in positions where it is absolutely necessary that the earth should stand at a greater angle than its natural slope, and that they should be constructed of some material which will neither splinter nor wound.

For similar reasons no casemates should be used which either are, or by racking could be made, pervious to even the heaviest shell.

12. *The guns should be pivoted well forward; and their muzzles should but just clear the sole of the embrasure when the gun is horizontal.*

The first of these suggestions has for its object to diminish the width of the embrasures; the second to make their depth a minimum; and both, especially with breech-loading guns, tend to close the neck of the embrasure against the enemy's shell.

Many of the guns at Alexandria were hit on the muzzle, but not one was injured by the blow, while the shell which dismounted the 8-inch gun in the west battery, Ras-el-tin Lines, passed between the muzzle of the gun and the sole of the embrasure.

It is true that if the muzzle of the gun be close to the sole of the embrasure, it will at each discharge tear away much of the latter: but such damage will not be excessive nor in a vital spot, and can in any case be repaired at night, while every inch which can be taken from the size of the embrasure is a great gain to the defence.

13. *Great care is necessary in all cases where the guns have fixed pivots, to ensure that the latter are strong enough to bear the constant recoil.*

Very many of the Egyptian guns were either unserviceable or about to become so, either from fracture of some portion of the hold-fast, or from the jamming of the trucks by the masonry which surrounded the pivot.

14. *A system of reliefs must be arranged for the gun detachments.*

This is necessary, not only in order to make provision for casualties, but because the labour of serving heavy M.L.R. guns is so great, that after some time the detachment would probably decrease very much in efficiency.

It is suggested that three reliefs be provided, of which 1 and 2 should come on duty alternately for an hour, while 3 should serve to fill up casualties in either of the others.

15. *Some system, better than the present, should be provided for traversing the guns.*

The process of traversing by means of tackles, or by a cog-wheel and winch, is slow and ill-suited to practice at moving objects.

Might it not be possible to give the required motion by means of hydraulic or other power, the requisite machinery to be under the control of the number who lays the gun?

16. *Some provision should be made for the possible use of vertical*

fire against ships. For this purpose it would be well that at least ten S.S. 13-inch mortars should form a battery, and that these batteries should be placed near, but by no means in rear of the gun batteries.

The range of any ship which has anchored or taken up a stationary position having been obtained from the gun battery, a salvo should be fired from the mortars, and repeated until the ship is forced to get under way.

The Egyptians do not appear to have used their mortars during the defence of Alexandria, for the reason, probably, that on account of their position which was almost invariably in rear of the guns, it was impossible to keep up a simultaneous fire from both weapons.

In concluding this paper, I beg to renew my former acknowledgments to those Officers who have assisted me in its compilation.

Finally, I venture to hope that among the many Officers whose experience or knowledge renders them far more capable than myself of judging of the value of the details which I have brought before you, those who may find in my paper nothing true that is new, or nothing new that is true, will be merciful to my shortcomings out of consideration for my good endeavour.

The CHAIRMAN: I am sure we all feel very much indebted to the lecturer for the interesting account he has given us of the observations he made whilst inspecting the works at Alexandria. He has brought the subject before us in a paper of a highly scientific character, and it is one on which I feel considerable delicacy in offering any remarks. At the same time, I understand, it is wished that there should be some discussion on the subject, and therefore we shall be glad to hear any remarks that any Officer has to offer. I confess I feel very great reticence in making any myself; because, first of all, the greater part of the paper is a naval subject, and the rest is entirely a matter of artillery and engineers, but no doubt there are Officers of these three services present, who know a great deal more than I can possibly do on those subjects.

Admiral Sir ASTLEY COOPER KEY, G.C.B.: I came here this afternoon quite unprepared to enter into any discussion upon this paper, and only rise as no other person appears inclined to take part in the discussion. I shall, therefore, only refer to one or two points that have occurred to me while listening to the interesting lecture, without attempting to discuss it in detail. And first, will you allow me to say, that I take exception to the use of the term "bombardment of Alexandria"? For my own part, I had no idea that the number of shell that fell in the town of Alexandria by accident was so small as I heard was stated, in the first part of this lecture, given a few days ago. It seems that the number of shell that actually fell in the town were very few indeed, and that they certainly did not cause the conflagration, but although instructed people know well that there was no bombardment of Alexandria, the world in general have spoken of it as if it was an attack on the town itself, and that it caused the destruction of a great part of it. Anyone who has followed the mode of attack will see that the Admiral was very much hampered in his attack on the forts, by his endeavour to avoid damage to the town, and I think we must say that he was thoroughly successful in that endeavour. I, therefore, deprecate the use of the words "bombardment of Alexandria." We should rather call the operations of the 11th July the attack on the forts of Alexandria, or "the destruction of the forts of Alexandria," but I should not use the word "bombardment." I was not fortunate enough to be able to be present on Friday to hear the first part of this very useful and able paper, but from what I have heard to-day, I must say that I generally concur with the lecturer in the views that he has given as to the mode of construction of coast batteries, except in one or two points, and it is simply to bring forward those one or two points that I have ventured to say a few words. In the

first place, I do not think it would be wise not to close the rear of a coast battery, because if you do not do that you leave a very weak point open for attack by a small landing force. There is a temptation, in such a case, for an enemy to land in the vicinity of the battery, and there you are with all your guns in front and open in the rear. In such a case the capture or destruction of the fort is easily ensured, unless, indeed, there were a large army in the vicinity. I am also not sure that a *parados* in the rear of guns is advisable; for in many cases, unless skilfully placed, it would form a shell trap, and a good deal of the effect of the shell may take effect on the gun's crews. I entirely concur in the use of earthworks as against ships in preference to masonry or brickwork. I think this is one of the most important points that we can insist upon. There are positions, like Spithead and others, where you cannot have earthworks; but wherever you can, place earthworks against ships, and I have for many years come to the conclusion, after considerable personal experience, that earthworks are far more secure for defence than stoneworks. I also concur in the view of placing the work high above the water level, up to about 100 feet. I do not think it is wise to place it above that, but from 60 to 80 feet is the best height for batteries to be placed. I would also place the batteries inland, at various distances if possible, and that the ships could never approach them within 2,000 or 2,500 yards; that places them beyond the effective fire of machine-guns, which, notwithstanding the little effect which they produced at Alexandria, I am confident we shall find a most valuable auxiliary in our ships wherever we can bring them within effective range of the works. At Alexandria they were at too great distance away to be of important effect, both as regards the Gatlings and the Nordenfelts. I hope that no one will think that I am an advocate for timidly attacking forts by ships. The two instances that we have had of late years, at St. Jean d'Acre and Alexandria, show that the Admirals commanding the fleets in each case just knew what they had to do, that they could do it, and they did it; but, depend upon it, the men who commanded the fleets, both at Acre and Alexandria, would not have taken the fleets they then commanded in the same way against fortresses of the highest class, with thoroughly well-trained gunners to work the guns. They formed a right estimate of what they had to meet, both in men and material, and from all that I have heard to-day, I feel more proud of the work of our fleet during the few hours during which it was employed, in driving the men from their guns, than I was before. You must not compare it to a siege where you can sit down and make a breach; the ships were moving; they were at such a distance that they could hardly see the guns or embrasures. Any attempt to make a *breach* from ships is out of the question. There was, evidently, no little real damage done to the works by the heavy fire brought upon them. This will induce us to be cautious in attacking permanent first-class fortresses with ships, but in this case we obtained possession of all the works in a few hours, with little or no real damage to our ships; and I should be glad to know what drove the enemy from their guns. There is one point with regard to the construction of forts, that I think might be added; that is the great advantage such works would have if they had a number of smaller guns in addition to their heavy ordnance. A large proportion of the exposed hull of the ship is unarmoured and penetrable by 64-pounders, and I believe that any works against which ships could be brought would have very much increased power if they had a considerable number of small shell guns in addition to those for penetrating armour. We are adopting this system in our ironclads, and I think the same rule holds good with regard to fortifications.

Colonel Lord WAVENEY, F.R.S., A.D.C., &c.: I must be permitted, in the first instance, to remark on the opening sentences of the gallant Officer who preceded me with respect to the term "bombardment of Alexandria." I quite understand the objection, but I trust it will not be held to have lost its place in the public language of Europe, inasmuch as in the debate on the Address, Lord Granville took particular care to point out the accuracy with which the Officers of Her Majesty's navy directed the fire of their guns exclusively against the forts with which they had to contend. That is a great thing to be said of the military service, under such circumstances, and it will always be considered, no doubt, as a very great credit to the combatant Officers of the expedition. Then, with regard to the lecture to which I have listened with a very great deal of pleasure, it has two very great advantages,

it seems to me. It leads us to think something of the future, and it reminds us of something of the past, which it is well not to forget. With regard to the future, I was particularly struck, in the early sentences of the paper, with the statement that the attacking force should resemble, as nearly as possible, floating batteries. No doubt our present enormous vessels contain great power of destruction, and as it seems to me also they contain great power of construction. This was brought very prominently forward some years ago, when I had the good fortune to be at Spezia, when experiments were made with the 100-ton guns. They were the guns intended for the "Duilio," and they were towed across the bay to the constructive base for breaching. There was first a large raft, of which I do not remember the dimensions—they are given in the papers of the Artillery Institution—on which the 100-ton gun was placed, for the purpose of experiment; and below, there was a deck of some 6 or 4 feet, which contained all that was necessary for working the gun, in addition to the steam power. Now, I am one of those who think that our mechanical appliances and our great wealth are capable of completing any experiment under any circumstances, anywhere. I believe I do not attach too much importance in that respect to the power of the Royal Navy. Referring also to our heavy ironclads, and the depth of water which they must require for their operations, and, seeing that there are many maritime fortresses as to which it would be very difficult to get an ironclad within breaching distance, I think it might be well if we had practically (as suggested by the lecturer), raft batteries. It seems to me, taking one of our large expeditions, such as that which appeared before Alexandria, with its power of carrying guns, and of turning out, even at sea, carpenter's gangs for the purposes of raft work, it might be very possible to form raft batteries, each capable of bearing such a 100-ton gun, as I saw at Spezia, which might be taken into shallow water and be made useful. It might be towed in by steam power. Then there is another thing; great weight has been laid on the invisibility, so to speak, of the engines of attack. This struck me particularly at Spezia. The first occasion on which I saw this large raft lying in position was on a blowing January day, when the sky was grey and the water grey. Any Officer will know how difficult it is to mark the position of any construction that is not at a very considerable height above the sea, and at that time this raft was almost invisible from any distance. I cannot, therefore, but think that great use might be made of our constructive power on occasions, or in emergency, by sending forward a raft battery so to speak, in advance of the heavy ships. Then there was another point with regard to this invisibility; the gallant Officer who has given us this lecture, spoke of the advantage of counter-guards. It appeared to me, in the old system of fortification, there must be some other reason for the counter-guard that we see in the Vauban system, than that of mere defence. In order to recall that specially to the recollection of gentlemen who have given their attention to it in the present day, I would remind them that the weak point at Strasburg, at the last siege, was protected from the German fire by a system of counter-guards, which lay in front of the point to which the German army desired to direct their force, and the result was, that that army was delayed in its progress for a considerable time. With regard to coast batteries, which come more immediately under the experience that I have had, I quite agree with what has fallen from the gallant Officer, as to the propriety of having them closed in the rear. They should be closed in rear no doubt, or they might be surprised at any time. But there is another simple plan which the French artillery practised continually, and it was this: they always marched into batteries with their carbines, and it is perfectly possible to organize such a defence with carbines, that you may carry on a gun defence against boats, and also a carbine defence against an attacking force. Then, again, with regard to the suitable height at which batteries should be placed, I recollect the instructions given us in 1853 with regard to coast batteries were, that the angle of depression should be 3° , and that will give a range suitable at all events for the artillery of those days, and a safe and easy means of determining the face of the battery. Another particular instruction then given us was, that what may be called the run of the sea in front of each battery should be accurately tested, so that you might be perfectly certain that the tendency of the state of the sea would be to bring the boats within the direct line of your artillery fire. I believe that was laid down as

a general rule for us, and it was so acted upon, but, as regards the power of invisibility, I believe that will be developed very much and very safely. With regard to the contrasted effect of heavy masses of fire and single fire, a very great deal has to be said as to the nature of the soil, and the mode of attack.

Lieutenant SLEEMAN, late R.N. : In listening to Captain Walford's very interesting lectures, I have been particularly struck with the very bad record placed against the shooting of the Nordenfelt gun, it being stated that although it fired 16,000 rounds, only five hits could be found. Now no doubt Captain Walford, in common with most artillery Officers, has a very great contempt for machine-guns, and no doubt rightly and properly has a very firm belief in the value of Shrapnel fire. Now I have personally had great experience with regard to the effect of Shrapnel bullets in the late Turkish war, and also considerable experience as to the effect of the fire of this particular Nordenfelt gun against iron plates, and also rocks and earth, and I wish to point out, that most probably the lecturer, having never seen the effect of Nordenfelt bullets fired against iron plates, or cement, or sand, or earthworks, he is very liable to have been misled, and to have attributed many of the hits due to the Nordenfelt fire to the Shrapnel bullet. The few hits he has mentioned were due to the bullet of the Nordenfelt gun striking the gun directly point on, which would leave an impression on the gun, showing that a pointed projectile had struck it, and so could not be attributed to anything but the Nordenfelt bullet. The Nordenfelt guns were fired against the rifled guns, principally in the embrasures and casemates, and probably nine out of every ten of their shot would have struck the guns at a very acute angle, and would have only left a blurr, more or less serious, according to the angle, which might be easily put down as caused by either pieces of common shell or Shrapnel bullets. It must be remembered that the Nordenfelt shot, at a distance of 2,000 yards, would possess a velocity of some 600 feet or more, and the power of the Nordenfelt gun is exceedingly great in comparison to its calibre. The shot of the Nordenfelt weigh half-a-pound, whilst the Shrapnel bullet has only 200 or 300 feet velocity at a range of 2,000 yards, and a sand shot is only 4 ounces in weight. Of the 261 Shrapnel shells fired by the fleet, 224 were fired at the Mex lines, leaving 37 which were directed against the Ras-el-Tin lines, and Fort Adda, and Fort Pharos, where 30 out of 37 rifled guns were mounted. I doubt if any naval Officer would have thought, for one moment, of firing Shrapnel shell against guns in embrasures and casemates, and therefore the whole of the Shrapnel fire was directed against the smooth-bore guns, which were fired above the parapets. I have risen to mention this, because I think the summing up of the lecturer, in which he states that he has very carefully examined the Egyptian guns, and also all the parapets, more especially referring to those of Fort Adda and Fort Pharos, and that he has put all the marks found in the parapet and the escarp down to the Shrapnel, and of the 8,000 Nordenfelt bullets that were fired at these forts, he says he can find no trace whatever, would produce an impression that the Nordenfelt gun was not as good as it was supposed to be, or else that our naval Officers and men firing these guns were excessively bad marksmen. It is very easy to understand that a Nordenfelt bullet, with its high velocity and weight, on striking a parapet would bury itself 3, 4, or 5 feet, and the probabilities are that after a lapse of three weeks there would be no marks left. The effect of the Nordenfelt bullet striking granite or stone would be very much the same as that of a cold chisel struck by a heavy hammer, it would break off large pieces, and the marks left might, unintentionally, have been put down by the lecturer to the effect of pieces of common shell or Shrapnel bullets. The lecturer has taken a good deal of trouble to show that the effect of the fire from the fleet was exceedingly small, and that it was inconsiderable considering the tremendous fire brought to bear on the Egyptian works. The natural question arises, if the fire was of no use, and did not damage the batteries to any great extent, why on earth did the Egyptian gunners leave their guns? Eye-witnesses who were present at the time said that the gunners could not keep to their guns on account of the rain of machine-gun bullets. The machine-guns fired were the Nordenfelt and the Gatling, at a range of some 2,000 to 4,000 yards, which is beyond the Gatling range. The Gatlings also fire only single shots against the volleys of the Nordenfelt. Probably few of the Gatlings reached, and of course the lead bullets fired from those guns would

not leave any marks at all. I thought it right to offer a few remarks upon this subject to remove the impression that might otherwise exist against the shooting qualities of our naval Officers.

Admiral The Right Honourable Sir JOHN D. HAY, Bart., M.P. : My gallant friend, Sir Astley Cooper Key, did not allude to one portion of the admirable lecture, in which Captain Walford laid down rather hard and fast rules that for the future it would be better for ships in all cases to engage batteries at anchor. I should be very sorry to hear that made an invariable rule of naval tactics. It is quite true where you have not much sea-room, or where there is much motion, it would be the better plan to adopt ; but where there is perfectly smooth water, and you have plenty of sea-room, I think there may be occasions in which it would be better to attack with the fleet in motion than at anchor. There is one other point which I wish to allude to for one moment, and that is, with reference to the position of the batteries, as regards their action upon the ship attacking them. It so happened, that I was employed in conjunction with Admiral Ryder, under the late Sir William Reed, then Governor of Malta, in arranging the defences of Malta against a possible sea attack, and my two colleagues came to the conclusion, with which I fully concurred, that it would be a great advantage to have variety of height and variety of distance. Especially for this reason : that after the smoke has begun to obscure the view, there is not so much difficulty for the land battery to obtain a range with which it is familiar, as there is for the ship which is attacking the land battery to vary its range, and therefore that the batteries in support ought to have their distance varied, and their height varied. With reference to the torpedo defences, I will say nothing because they are well-known to all who are here, but I thought it right to mention those points which have not yet been touched upon, so that the lecturer may touch upon them in his reply.

Vice-Admiral BORS : I only wish to make one or two remarks with reference to this lecture. The gallant Officer has given the armament of the fleet as consisting of eighty-four heavy guns, and from the paper it would appear that all these guns were available to engage at one time, but as there were only two turret ships whose guns could fight on both sides, and the remainder could only use one broadside at a time, the actual number of heavy guns that could engage was only forty-four. The gallant lecturer says, " From these statements I draw the conclusion that in future bombardments it is probable that ships will attack forts at a range beyond the armour-piercing power of ordinary projectiles." That range is so very vague and unlimited, that I do not think it can be considered as a conclusion to be drawn from what happened at Alexandria. I do not say where the ships should be, but I think in future bombardments, it must be left entirely for the Admiral in command to decide his distance, or whether his ships shall fight under weigh or at anchor, according to the circumstances of the case, such as the nature and armament of the batteries or other defences, the proficiency of the garrison as gunners, and the navigable condition of the locality. If the Government provide Officers in command with the different descriptions and types of vessels required, it must be left to them to appropriate those ships to the special duties for which they are most suitable, especially as to range. With regard to the Nordenfolt guns, I would observe they were engaged at a very long range. The lecturer thinks one thing as to their effect, Lieutenant Sleeman thinks another. No one can really tell what the effect was, except those who were actually in the batteries at the time, and it would be very instructive and interesting if we could possibly get information from some intelligent Officers or men who were engaged in the batteries, as to what was the effect of the machine-gun fire, and what bearing it had in silencing the fire of their guns. With regard to the relief reserves, I think the lecturer has said that the heavy guns require more reliefs on account of the labour attached to working them. I do not quite agree with him, because, whether a soldier or a sailor is working a 6-pounder, or an 80-ton gun, he is exerting himself to the utmost all the time, and one does not want relief more than the other ; they are necessary for both.

General SCHOMBERG, R.M.A. : I hope I may be allowed to make a few remarks. In the first place, I should like to ask two questions. The lecturer has spoken of the character of the fire from the ships. I should like to ask some of the naval Officers

present who were in action at the bombardment, if they would give us some account of the kind of fire ; was it simply independent firing, or was there any attempt to use electric firing ? I should like also to ask a question about the construction of the Egyptian parapets ; were they constructed of earth or sand ? I quite agree with Sir John Hay's remark, with regard to the first point, which the lecturer deduces at the conclusion of his paper. "It is of importance that the batteries for coast defence should have a considerable command over the sea ; but should not be conspicuous objects on the coast." I also think it would be a very great advantage to have them dispersed ; for instance in defending such a place as Plymouth, if the batteries were scattered, it would be impossible for ships to concentrate their fire upon them. I think No. 4 is a most important point : "Great care must be taken to render the magazines and stores absolutely secure, and also to provide bombproof cover for the garrison." I think also, if possible, there should be cover for the number of gun detachment who are not actually at work in rear of the gun-slide. The suggestion as to the counter-guard also appears to be most important. With regard to No. 7 : "Each gun should be divided from its neighbour by a bombproof traverse, and a parados should be provided in rear of each battery." I think it is of the utmost importance that heavy guns should be divided from each other ; many of the batteries of older construction, such as at Plymouth, would be considerably strengthened by removing every other gun, and constructing an iron traverse in its place ; not so much for protection for the gunners as to prevent noise and confusion, so that the gun detachment might be perfectly undisturbed at their work. They would be firing at ships in rapid motion, and nothing should interfere with them, or distract their attention. No. 12 states : "The guns should be pivoted well forward, and their muzzles should but just clear the sole of the embrasure when the gun is horizontal." That seems to me a very good suggestion also. As to the parados (No. 7), I quite agree that it should not be a shell-trap, but I think if it were removed a sufficient distance from the gun detachment, it would be most valuable, and would, as the lecturer says, protect any barracks or other construction in rear of the battery from being hit by stray shell. "The system of reliefs must be arranged for the gun detachments." I quite agree with the lecturer on this point. I have been at work for forty-two hours consecutively, and I know the tremendous strain it is on sinews and brain to work so long. I think his arrangement of three detachments is very good, but I would keep them longer than one hour at work. "Some system better than the present should be provided for traversing the guns." I perfectly agree with this ; I think that hydraulic power probably might be so employed, but in the event of any such power becoming disabled, there should always be a probability of falling back on tackles or cogwheels. "Some provision should be made for the possible use of vertical fire against ships." I am afraid we are very much neglecting vertical fire. When shell guns were brought into common use, the same mistake was made. We fancied everything was to be done by horizontal fire ; and in consequence, at the siege of Sebastopol, there was a vast waste of ammunition. It seems to me we are repeating the same mistake, we are not paying sufficient attention to vertical fire. But its employment against single ships will usually result in a wasting of ammunition, though, as the lecturer observes, it may be very useful in forcing ships to engage batteries under weigh. However, the legitimate employment of vertical fire is against larger objects, such as arsenals or fleets. A sufficient number of mortar-boats armed with rifled mortars, if it did not destroy, would at any rate considerably damage any fleet collected behind such a breakwater as Plymouth, for instance. There may be an idea that the rifled mortar will prove to be more accurate than the old mortar. My opinion is, the new mortar will only be more accurate in direction, and, that its variation in range at high angles of elevation will be much the same as that of the old smooth-bore.

The CHAIRMAN : In closing this discussion I think it right to say one or two words merely on the general subject. I am very glad that my gallant friend, Sir Cooper Key, made the remarks he did about the "bombardment of Alexandria." I consider it is an improper term, and I consider that we never did bombard Alexandria, though we did bombard some of the forts of Alexandria. It is perfectly correct, as the noble lord said, that Lord Granville made those remarks, but he made them

exactly in the spirit and sense in which the gallant Admiral made them. That there was a bombardment everybody knows, but the bombardment was of the forts, and the lecture has shown that there were only one or two shells that actually fell into the town of Alexandria, and those purely by accident, showing the great attention paid by everybody on board, in order to avoid the possibility of any such accident happening as the bombardment of the town of Alexandria. I look upon this as of great national importance, because it is one of the things that has often been stated, that we had no right to go and bombard a town like Alexandria. We never did bombard Alexandria, it was the forts that we bombarded, and why? Because they were a danger to the fleet, which we were obliged to keep there, and it being so, we were justified in bombarding that which put our fleet in danger. On that ground I contend, whilst we were perfectly justified in doing the one, we should have been extremely wrong to have done the other, and the lecturer has, through his ability, shown us most forcibly that what I am now stating is exactly what took place. I think this fact reflects the highest credit on the Admiral and the Officers of the fleet, and when we are told that the fire was bad and irregular, I entirely disagree with the statement. I say the very thing I am pointing out proves that the fire was good, that it was well directed, and why? It is ridiculous to suppose that every shot is to hit in the exact place anticipated, it is impossible; distance, light, everything shows that there must be great doubt and uncertainty, and when we look at what has occurred, I think we must say that on the whole the fire was extremely good. And you must remember another thing, that the fire in action is a very different thing from firing at the butts at Shoeburyness. There you stand in great comfort, you have every means and appliance at your command, but in action you must take the things as they come. It is a very different thing from preparing for hours and days beforehand in order to produce a good shot, or to let your shell drop exactly where you want it. And I say, taking all in all, I think we have had enough to-day to satisfy us that the principle upon which our naval gunnery is conducted is sound and wise. As regards the forts, I beg entirely to agree, as far as I can judge, with the conclusion that the lecturer has arrived at, that earth forts as against batteries are decidedly very superior to stone or any hard material. You must always bear this in mind, that there are a great many instances in which you cannot have earth, and you must have stone; therefore, you must not assume that because as a rule, and as a principle, it is sound and wise to adopt, where you can, the earth, it is not as a natural result necessary occasionally, often, to have stone or stronger material. For instance, in forts in the sea, sometimes you could not make them of earth. Therefore, with that reservation, I think that wherever it can be done, the most efficient sea batteries as against a fleet are decidedly earth batteries. Even as long ago as when we were in the Crimea, I remember it was the "Wasp" battery—not a stone battery but an earth battery—which did our fleet more damage than many of the fine batteries standing round in every direction. I think it will be found that we felt that even then, and no doubt what we know now only confirms that point. There is one other point I am very glad to refer to. No man has a higher opinion of the Royal Navy than I have; no man has a higher opinion of the great fighting element that it is to this country; but I am quite satisfied from what we have heard to-day that the navy thinks that forts are very uncomfortable enemies to deal with, and whilst we are a great naval Power, we should certainly not neglect the fact that all our ports have vulnerable points, and that where those vulnerable points exist, it is worth while that money should be spent in order to put up proper forts to defend them. This is a very important subject for two reasons; first of all, forts are very expensive; and it is well known that when it comes to a matter of expense, people are apt to dislike to meet it. If you do not meet the expense, what is the result? That your navy cannot produce the effect which it would do, if it had those forts to back it. If it were not for the forts to hold these points, the navy would not be free to move about in various directions and cover the oceans. Those two points are of such importance, that I think it is essential we should not forget, that whilst we are a naval Power and are grateful to be in a position to retain our naval superiority, that that naval Power must be backed by military positions, such as have to be defended by forts, and that the forts are a great element in our naval

superiority. I am sure we are all very much obliged to the lecturer for the admirable lecture that he has given us to-day.

LORD WAVENEY : I am sure your Royal Highness will allow me to say that when I spoke of the "bombardment of Alexandria," I spoke of it in the same sense in which Lord Granville spoke of it. I imagined that I expressed myself in those terms. I did not at all wish to say that it was a bombardment of the town, but simply that it was a bombardment of the forts.

THE CHAIRMAN : I am very sorry if I misunderstood it, but certainly I fancied that the noble lord did not agree with the gallant Admiral ; that was my impression.

Captain WALFORD, in reply, said : With regard to what Lieutenant Sleeman said as to the Nordenfelt guns, I am sure that no one who had seen a single mark of a Nordenfelt bullet, at Alexandria or elsewhere, could fail to know it again. I could only compare it to the mark of the Palliser shell. The Nordenfelt bullets which we noticed had produced very great effect, but I can safely say, that on no other gun in Alexandria was there a single Nordenfelt mark, except those which I have mentioned. With regard to the parapets, they were not earth, they were sand and covered with cement ; that is to say, every shot that struck that cement marked it, there could be no mistake about it. The escarps were covered with cement, and in the case of those escarps which I have mentioned, I picked the Shrapnel bullet out of the cement myself. It was reported to me by an Officer of the navy, that the gun in the Hospital battery had been struck by a Nordenfelt bullet. I went to look at the gun and I was sure at once that it was not a Nordenfelt. The deepest hole was hemispherical, and $\frac{1}{2}$ -inch deep. The shallowest of the Nordenfelt hits we found, was somewhere about 1-inch deep, and certainly not hemispherical. I was so convinced that these were Shrapnel bullets, that I stayed ten minutes or a quarter-of-an hour with that gun. I traced the bullet, and eventually dug it out from the front of the carriage, and it was a Shrapnel bullet ; I have it here. My own belief is, that the Nordenfelt is an excellent gun, but that the range was too long for it. I should wish to say, I do not consider the effect of fire from the navy was by any means small ; I consider it was very great indeed. The amount of destruction done in the forts was absolutely surprising. The quarters, and stores, and buildings in the rear were demolished. All I say is, if the parapets of modern forts are made of a reasonable thickness, say 30 feet, I do not think any shells which the navy will fire need drive the gunners away from their guns.

NAMES OF MEMBERS who joined the Institution between the 1st January
and 1st April, 1883.

LIFE MEMBERS.

Hoskyn, R. F., Lieut. R.N.	Warren, H. A., Lieut. R.N.
Hammick, R. F., Commander R.N.	Hickes, H. J. F. E., Colonel R.H.A.
Harfield, W. H., Lt.-Col. Middx. Yeo.	Newdigate, F. A., Lieut. Cold. Gds.
Everitt, S. G., Lieut. Royal Welsh Fus.	Bolitho, O. G., Major 3rd Dragoon Gds.
Egerton, G. G. A., Lt. Seaforth Highs.	Lang, E. L., Lieut. R.N.
Ross, J. J., Major h.-p. late 13th Regt.	Kane, H. C., Capt. R.N.
Nairne, C. E., Lieut.-Col., C.B., R.H.A.	Grey, G. A. G., Commander R.N.
Harrison, C. E., Lieut. Rl. W. Kent Rgt.	Thompson, L. C. F., Capt. the King's Regiment.
Greatwood, H. F., Lt.-Col. late E. Surrey Regiment.	Broadwood, Francis, Lieut. S. Stafford Regiment.
Hordern, L. H., Lieut. R.N.	Evans, E. R., Capt. Rl. Welsh Fus.
Lambert, C. J., Esq., M.A., F.R.A.S.	

ANNUAL SUBSCRIBERS.

Dobbs, G. C., Capt. Bo. S.C.	Morris, Sir E., K.C.B., Commissary-Gen.
Starr, G. L. H., Capt. Innis. Fus.	West, M. R., Major R.A.
Griffiths, C., Lieut. York and Lanc. Regt.	Conor, C., Major West Riding Regt.
Frederick, C. A. A., Lieut. Cold. Gds.	Thomas, A. B., Capt. R.N.
Gardiner, S., Major R.A.	Finch, W. J., Lt.-Col. R.A.
Goldfrap, H. C. S., Capt. Linc. Regt.	Richards, S. S. C., Lt.-Col. Bloomsbury Rifles.
Kingsford, H. C., Lieut. R.N.	Middleton, R. W., Lieut. R.N.
Connolly, E. M., Major-General.	Helby, H. W. H., Mid. R.N.
Burton, H., Lt.-Col. 3rd Mon. Rifle Vols.	Ersikine, J. F., Lieut. Scots Gds.
Stevens, A. J., Capt. 3rd Mon. Rifle Vols.	Groves, E. A. W. S., Major Rl. W. Kent Regiment.
McKay, J., Major-General.	Richards, Sir Frederick W., K.C.B., Rear-Admiral.
Poe, E. S., Commander R.N.	Dineley, F. G., Mid. R.N.
Jeffreys, W. R., Lt.-Col. late R.M.L.I.	Hamilton, P. F., Capt. R.A.
Fox, H. C., Capt. 3rd Batt. Rl. Fus.	Jackson, H. K., Lieut. R.A.
Payne, E., Commander R.N.	Moon, W. G., Lieut. 4th Bt. E. Surrey Regiment.
Sandford, H., Lieut. R.N.	Stuart, H. B., Esq., late Bengal Army.
Manners, C. G. E. J., Lieut. Gren. Gds.	
de Burgh, U. G. C., Capt. 7th Drag. Gds.	
Gordon, W. E., Capt. R.N.	
Halford, C. H., Lieut. Gren. Gds.	
Randall, J. H., C.B., Commissary-Gen.	

OCCASIONAL PAPERS.

This portion of the Number is reserved for Articles, either Original or Compiled, on Professional Subjects connected with Foreign Naval and Military matters; also for Notices of Professional Books, either Foreign or English.

It is requested that communications or books for review may be addressed to Colonel Lonsdale Hale, at the Royal United Service Institution, Whitehall Yard, London, S.W.

THE RUSSIAN ARMY IN 1882.

Die Russische Armee in Krieg und Frieden nach den neuesten Reorganisations-Bestimmungen und anderen Quellen dargestellt. Von A. v. Drygalski, Königl.-Preuss. Premier-Lieutenant A.D. Berlin, 1882.

"The Armed Strength of Russia." Compiled in the Intelligence Branch of the Quartermaster-General's Department, Horse Guards. War Office, London, 1882.

"Revue Militaire de l'Etranger" (Nos. 543, 561, 563, 565, 567). This valuable periodical furnishes us with details of all changes made in the Russian Army since the publication of the two above-mentioned works, thus enabling us to correct a certain number of statements contained in them, which were doubtless accurate when made, but have now ceased to be so.

No army in the world has probably undergone, within the last thirty years, such a succession of extensive alterations in organization, in administrative arrangements, and in tactical regulations as that of Russia. The Crimean war surprised it during a period of transition. Further changes of importance were carried out after that war. Once more, in 1874, the whole military system was remodelled, whilst ever since the peace of San Stefano radical reforms have been in progress, and have, during the latter half of 1881, as well as during the whole of 1882, been prosecuted with such feverish haste that it is difficult for the observer to keep pace with them; as an instance of which we may mention the fact that the latest edition of the Manual published, at uncertain periods, by the Russian Government for the benefit of officers, having appeared in the summer of 1881, much of the information contained therein is already obsolete, a great number of most important regulations having meanwhile been altered. Some further changes of no little consequence have been made since the publication of the first two works above mentioned, upon which the present article is chiefly founded—a remark which particularly applies to the valuable compilation issued by the British War Office; changes in matters of detail are still being made, and further minor changes will doubtless continue to be made; but, as the whole framework of the new Russian military system seems at length to be firmly constructed, the season appears to be a favourable one for taking a survey of the Russian Army as known to us in 1882.

First of all let us glance at the extent and resources of the empire which that Army has to protect.

The Russian Empire.

1. *European Russia :*

	Area in square miles.	Population.
Russia proper	1,895,486	65,849,610
Kingdom of Poland	49,158	6,528,017
Accession in Bessarabia (1878)	3,274	127,000
Grand Duchy of Finland	144,226	1,941,255
Cis-Caucasus	87,100	1,836,694
	<hr/> 2,179,244	<hr/> 76,282,576

2. *Asiatic Russia :*

Trans-Caucasia....	82,475	3,555,050
Accession in Armenia (1878) ...	9,950	576,747
Siberia	4,824,479	3,440,362
Central Asia	1,305,461	4,505,876
	<hr/> 6,222,365	<hr/> 12,078,035

3. *Grand total Russian empire* 8,401,609 88,360,611

The estimate of population is only approximate ; it is based upon the census of 1871, and modified by subsequent calculation. The last census was taken in 1880, but the results have not yet been published. The population of the empire may be set down, in round numbers, as 90,000,000.

It is very unequally distributed throughout the empire, there being an average of 35 inhabitants per square mile in European Russia and only of 1.94 per square mile in Asiatic Russia.

The most thickly populated districts are the central provinces, "Great" and "Little" Russia, West Russia, and Poland ; "but the provinces to the east and north-east of these districts have comparatively few inhabitants on account of their severe climate and poor soil, while the great trackless steppes to the southward are equally unsuited for maintaining a large population."¹ The great mass of Russians are agriculturists. There are only ten cities containing more than 100,000 inhabitants, including St. Petersburg, 670,000 ; Moscow, 602,000 ; Warsaw, 337,000 ; besides which there are eighteen towns with a population ranging between 40,000 and 86,000. There were 14,151 miles of railway open for traffic in July, 1880—the last date for which we have any official returns. Railway construction was only commenced in earnest in 1862, chiefly for military reasons ; and the tracing of the several lines has been influenced more by strategical than by commercial considerations. The rate of progress has of late years been rapid, averaging about 700 miles annually opened to traffic. Much, however, remains to be done before Russia can occupy as advantageous a position in this respect as the other European nations ; for instance, Great Britain and Ireland, which, with an area of about 120,000 square miles, had, in 1880, 18,049 miles of railway in operation ; and what more immediately concerns Russia, especially from the military point of view, one of her immediate neighbours, the German empire, with an area of 210,000 square miles, has 21,170 miles of railway, and the other, Austria, with 228,000 square miles, has 11,690 miles of railway. Russia, with her area of 8,000,000 square miles and 14,000 miles of railway, compares unfavourably with the adjacent empires—a circumstance which must enter largely into the calculations of her statesmen. Inland navigation is, on the other hand, widely developed, and may be of military importance under certain circumstances. There

¹ "Armed Strength of Russia."

is direct water-communication between the Caspian Sea and St. Petersburg, a distance of 1,434 miles, chiefly by the Volga, but partly by canal. "There are four steamboat companies that navigate the Volga with first-class river steamers; this noble river running a course of 2,000 miles without a rapid, whirlpool, or sandbank."¹ The total extent of inland navigation is as follows:—canals, 865 miles; navigable rivers, 18,935 miles; total, 19,800 miles. Although, as we have seen, much has been done of late years in the way of railway extension, the roads appear to have been but little improved, and to be still, as a general rule, atrocious.² When we consider the severity of the climate in the greater part of Russia, the enormous distances which separate the principal centres of population and of government from each other, and from other parts of the empire, and, lastly, the very insufficient means of communication which exist, we are able in some measure to appreciate the great difficulties encountered by those responsible for the organization, instruction, and mobilization of that vast machine, the Russian Army—difficulties which meet them at every step, and which must, as far as we can see, always prevent that Army, no matter how able its administration may become, from being equal as a fighting machine to that of its great western neighbour.

Imperial Revenue and Expenditure.

(From "Armed Strength.")

				English equivalent at full silver value of rouble.	English equivalent at depreciated value of paper rouble.
I.	Total Revenue. <i>Roubles.</i>			£	£
1879	661,954,192			104,938,657	68,953,561
1880	651,016,683			103,204,793	70,526,807
1881 .. (estimate)	717,461,609			113,738,181	74,735,583
1882 .. (estimate)	762,004,512			120,799,543	82,550,489
II.	Total Expenditure. <i>Roubles.</i>			£	£
1879	643,892,258			102,075,363	67,072,109
1880	694,505,313			110,098,987	75,238,076
1881 .. (estimate)	717,461,609			113,738,181	74,735,583
1882 .. (estimate)	762,004,512			120,799,543	82,550,489
(According to Drygalski) 658,595,151					
III.	Army Expenditure. <i>Roubles.</i>			£	£
1879	187,451,193			29,716,381	19,526,165
1880	208,577,436			33,065,499	22,595,889
1881 .. (estimate)	206,715,302			32,770,707	21,533,156
1882 .. (estimate)	183,489,042			29,088,270	19,877,980

According to the regulations promulgated in 1873, the normal expenditure on the Army was fixed at a maximum of 179,290,000 roubles, which amount was not to be exceeded except by special sanction of the Czar.

This comparatively low rate of expenditure was, however, only adhered to for a very short period; and from 1876 onwards we find that supplementary

¹ "Progress of the World" (Mulhall). There are now (1883) six steam companies for passengers, besides several for "tugs."—(L.G.)

² "Russia," by D. Mackenzie Wallace. Vol. I, pages 20-24.

credits were granted, bringing up the Army charges to the high rates shown in Table No. III. This increase in expenditure is independent of money raised to carry on the late war against Turkey to the amount, according to official statements, of £130,000,000.¹

The present Emperor, alarmed at the enormous cost of the War Department,—a cost which the resources of the empire seemed inadequate to meet—determined upon a course of vigorous retrenchment, and ordered a considerable reduction of the peace establishment (from 863,000 men to 756,000), and various other minor economies, thanks to which the Army budget of 1882 shows, as we have seen, a reduction of 23,229,260 roubles. Reasoning from previous experience, we are inclined to doubt the permanency of this fit of economy; at any rate it appears probable that no further reduction of expenditure is likely to be carried out, as it is intended to improve the position of the non-commissioned officers and private soldiers by giving them higher pay and better quarters, also to provide ranges for target practice,² riding-schools, &c.

Already, too, the estimate for pay and allowances of officers was increased in 1881 by the sum of 1,571,000 roubles, although the strength of the Army had been reduced by 107,000 men, with a proportionate reduction of officers. It is hoped that this and other proposed additions to Army expenditure will be balanced by economy in other respects, and that if peace is maintained, and the same principles are applied to all the public services, the deficit will in a few years be converted into a surplus. The large reduction in the peace establishment of the Army, though doubtless beneficial to the revenues, and probably, for financial reasons, absolutely necessary, is somewhat detrimental to the military strength of Russia, as it reduces the number of trained soldiers who will pass annually into the reserve—an event which will make itself all the more felt if the intention now entertained is carried out of increasing the length of service by one year in both infantry and cavalry.

The Conscription.

The military system of Russia is based upon the principles of universal liability and of territorial distribution.

The imperial ukase of the 1st January, 1874, at present regulates the recruitment of the Army, being applicable to all parts of the empire except the Grand Duchy of Finland (population in 1879, 2,028,021), the Cossack regions (male population in 1880, 1,110,000), and lands occupied by certain foreign races in Trans-Caucasia and other remote parts.

The following are the main provisions of the regulations affecting the land forces, issued in accordance with the ukase above referred to:—

The entire male population, without distinction of class, is liable to military service.

Exemption, by purchase or by obtaining a substitute, is prohibited, except in the case of a brother or cousin under certain conditions.

The number of men required for the annual contingent is fixed by the legislature every year on the recommendation of the Minister of War, and is promulgated to the Senate by imperial ukase.

¹ "Progress of the World."—MULHALL.

² Budgets being, so to say, retrospective in Russia, that of 1882 is as yet unpublished, and we know not what saving, if any, was effected; but the following further items of extra expenditure must militate against economy:—1. The new dress, which requires more cloth, and entails a more expensive cap. 2. The contemplated increase of 50 per cent. to the Cavalry, and that to the Horse Artillery. 3. The fortifications of Kovno and the Polish Triangle, with connecting railroads. 4. The cavalry concentration under the Grand Duke Nicholas. 5. The Transcaspiian works.

Admission to the service, or exemption therefrom, depends upon the number drawn by the individual, every man declared liable and fit to serve having to take part in lot-drawing once during his lifetime. Those who are exempted by drawing so-called "lucky" numbers are enrolled in the "Opoltchenié," of which more hereafter.

One class only of the population is annually called upon to take part in the drawing, namely, that including all men who have attained the age of twenty on the 1st January of the year in question.

Persons who have fulfilled certain educational requirements may relieve themselves from lot-drawing by enlisting as volunteers under conditions to be hereafter specified.

The annual levy of recruits for the active Army has hitherto taken place in Europe between the 1st November and the 15th December, and in Siberia between the 15th October and the 31st December; but it is intended that in future all recruits shall join on the 1st December, so as give them more time for preparatory drill.

The ordinary duration of service is fixed at fifteen years, of which six with the colours and nine with the reserve; but, in the case of men serving at some of the more distant Asiatic stations, the total length of service is reduced to ten years, of which seven with the colours and three in the reserve.

In time of war men can be retained with the colours as long as required.

The Minister of War has by law the power of sending any private soldier to the reserve before the completion of his active service, and it has been the custom of late, from motives of economy, only to keep men four years with the colours; but it is intended that in future the actual terms of active service shall be prolonged in the case of infantry and garrison artillery to five years, and in the case of all other branches of the Army to the full period of six years.

Reduction in the length of active service is also made on account of educational proficiency as follows:—

1. To six months (about to be raised to eighteen months) with the colours, and fourteen and a half years in the reserve, in the case of men who have taken university degrees or who have passed equivalent examinations.

2. To eighteen months with the colours (about to be raised to three years), and thirteen and a half years in the reserve, in the case of men who have finished a certain specified course in a gymnasium or second-class school.

3. To three years with the colours (about to be raised to four years), and twelve years in the reservé, in the case of men who have passed through a third-class school.

4. To four years with the colours, and eleven years in the reserve, in the case of men who have passed through a primary or fourth-class school—in other words, who can read and write.¹

Exemptions.

The exemptions may be divided into two principal classes:—

1. Those entirely released from military liability, who may be again subdivided into—

- (a) Those exempt for family reasons, which are many and various, and

¹ Education has made considerable progress in Russia since the emancipation of the serfs; for whereas in 1860 only two per cent. of conscripts could write, in 1870 the proportion had risen to eleven per cent. (*vide* "Progress of the World," Mulhall, page 380). The same authority, however, states that in 1880 there were 1,500,000 children at school—a small number for such a vast population, and showing no great increase over the number of scholars returned in 1867, namely, 1,155,773 (*vide* "Statesman's Year Book," 1870).

similar to those admitted in other countries where conscription is in force.

(b) The clergy of all Christian denominations, and singers in Orthodox churches who have completed a course of study at an ecclesiastical academy. Persons, however, who resign their duties in the Church after a period of six years are enrolled in the reserve : if they resign before this term, they become liable for duty with the active Army.

2. Those released from liability to serve in peace time, and enrolled for fifteen years in the reserve, and with the obligation to serve in war time if required.

This class includes all members of the medical profession ; exhibitors of the Academy of Fine Arts ; also professors and other instructors in public schools and colleges.

Postponements.

Individuals who personally manage their estates, or direct their own commercial or industrial establishments (*with the exception of vendors of strong liquors*), may have their entry into the service postponed for a period not exceeding two years.

Students in certain educational establishments are, if they wish it, allowed to postpone taking part in the drawing for periods ranging from two years to eight years, according to the nature of their studies, to their proficiency, and to the class of establishment at which they are being educated.

All such students are allowed also to declare, two months before the time of lot-drawing, whether they wish to enter the service as volunteers, in which case they are relieved from the drawing, and are allowed the same indulgence as to postponement of service.

Volunteers.

Men can enlist voluntarily under the following conditions :—

They must be at least seventeen years old.

If minors, they must have the consent of parent or guardian. They must be physically fit, and must have complied with certain educational requirements.

Enlisted volunteers are divided into three classes—

1. Those who have passed through a first-class establishment ;
2. Those who have passed through a second-class establishment ;
3. Those who have passed the special examinations appointed by the authorities.

Class 1 need only serve three months with the colours.

Class 2 is retained six months.

Class 3 must remain two years.

All volunteers serve nine years in the reserve. They may enter the service at any time of the year. Only a limited number is allowed in each corps or regiment. Those joining the Guards or the Cavalry must maintain themselves at their own expense. Those who wish to do so, may live in private quarters, except when in camps of instruction. They all join as privates, and perform all the duties of the same, with certain exemptions. Those who can pass the required technical examinations may, with the consent of their commanding officer, be promoted to the rank of non-commissioned officer after two months' service, if belonging to the 1st Class ; after four months' service, if belonging to the 2nd Class ; and after one year's service, if belonging to the 3rd Class.

First-class volunteers, after serving three months as non-commissioned officers, may be promoted to the rank of Officer ; those of the second class,

after six months; and those of the third class after one year; but no such promotion can take place unless the candidate has served in camp during at least one period of exercise.

Students at the various military schools are considered to be enlisted volunteers; time spent in the schools counting as service with the colours.

There is another kind of volunteer, called "Okhotnik." He must be under thirty years of age in peace, and under forty in war, and not be liable to conscription.

The terms of service are the same as for other recruits.

Results of the Conscription in 1878.

I. Total number of men attaining the age of 20...	...	759,055
II. Number of men actually enrolled for the Army	...	207,691
" " " " Navy	...	5,396
Total contingent	...	213,087

Exemptions, Postponements, &c.

Exempt for family reasons	...	388,384
Passed direct into the reserve	...	1,142
Struck off lists	...	15,806
Exempt by purchase under old regulations	...	711
Rejected	...	46,038
Granted postponement on various grounds	...	2,852
Sent to hospital for treatment	...	6,380
Put back to next year	...	51,269
Deficiencies in local contingent	...	3,060
Failed to appear	...	27,190
III. Total exemptions, &c.	...	542,832
Add together II and III	...	755,919
Subtract II and III from I, there remains a surplus passed direct into the "Opoltchenié," &c.	...	3,136

General Results of the Conscription in 1879.

Total number of men attaining the age of 20	...	794,000
Total contingent demanded for Army and Navy	...	218,000
Recruits medically inspected	...	265,750
Of whom, rejected as unfit (21.9 per cent.)	...	58,150

General Results of the Conscription in 1880. ✓

Total contingent demanded for Army and Navy	...	235,000
Total number of recruits enrolled	...	231,961

There was a deficit of 3,309 men, of whom 3,000 were Jews.

In September, 1881, in consequence of the reduction of the peace establishment, the annual contingent was reduced to 190,000, with 22,000 additional who are only to serve one year, on account of family reasons—a class of soldier which it is intended to increase.

Standard of Height.

Corps.	Height.	Other Qualifications.
	Ft. Ins.	
Guard, all arms, including sailors.....	5 6½	Picked men.
Grenadiers.....	5 4¾	Selected after the Guard.
Rifles.....	5 1¼	Not over 5 ft. 4¾ ins. Broad-shouldered in proportion.
Cavalry of the Line	5 4¾	Not over 5 ft. 10 ins. Build suitable for horsemen; short-legged, bow-legged, and knock-kneed men not taken.
Artillery.....	5 4¾	Strongly built. Half of the Horse Artillery must be 5 ft. 8¼ ins.
Engineers.....	5 1¼	Broad-shouldered. If possible, smiths, carpenters, or such like.
Gendarmes.....	5 4¾	Only men who have to serve the full six years taken. Other qualifications as for Cavalry.
Customs Guard.....	5 3	Good sight and hearing. Other qualifications as for Cavalry.

After providing for the wants of the special corps named in the above Table, the best of the remaining recruits are allotted to the Infantry, the Reserve Infantry, and the Convoy Detachments. Men over 5 ft. 4¾ ins. are not posted to a local corps. Conscripts, not fit for service as combatants, are posted to corps as non-combatants.

In 1875, about 75 per cent. of the Russian Army were Russians proper. 79·47 per cent. of the conscripts were totally illiterate, and 75 per cent. were peasants.

Jews are not admitted into the Fortress Artillery, Local Battalions, Convoy Detachments, Customs Guard, or Navy. Mahomedans are not taken for troops serving in Turkestan.

European Russia, except Poland, the Baltic provinces, and Finland, is divided for recruiting purposes into 164 districts, answering to the number of line infantry regiments, each of which is recruited in its own district. Other corps are recruited throughout the empire.

Poland and the Baltic provinces are divided into districts; but the recruits raised in them are distributed throughout the Army, composing about 20 per cent. of the strength of each regiment. The Grand Duchy of Finland has military laws peculiar to itself.

The present law of conscription, as affecting the empire generally, will not produce its full effect till 1889, when, supposing the annual contingent now fixed by law to have been in the meantime maintained, and allowing the usual annual per-centage for casualties, the number of trained soldiers available for the regular Army will nearly amount to 2,600,000. In the present year it is estimated at 2,145,000.

Although the Guards get the pick of the recruits, and after them the Cavalry, Artillery, Engineer and Rifle battalions have the choice, yet the Infantry, too, is composed of right good material, although varying a good deal in appearance and physique, according to the districts from which it is recruited. In addition to the ordinary conscripts, there are in the ranks a certain per-centage of men who, having obtained the necessary educational certificate, have the right to choose the corps in which to serve, either for six months or for eighteen months, according to their degree of education. Then,

again, there are men who volunteer, and who belong to one of the three first classes (as to education); these have to serve, according to their class, either three months, six months, or two years; and, thirdly, the so-called *Ochotniks* (corresponding to the German three-year volunteer), who have the right of selecting their corps, but must soldier for four years. From the last-named class most of the non-commissioned officers are drawn. Latterly, another class of soldier has been introduced into the service, namely, those who, on account of family reasons, are only required to remain one year with the colours, after which they pass for fourteen years into the reserve.

But, after all, the great majority of the recruits are those who have drawn their number, and who have to serve the full period. They are generally very illiterate. Of 231,677 men enrolled in 1880, only 243 had 1st class certificates; 394 had 2nd class; 1,465, 3rd class; and 1,897, 4th class: that is to say, there were 3,999 men with some education. Only 20 per cent. of the whole contingent could read and write.¹ However, this want of education among the conscripts is a good deal remedied by the company schools which all soldiers have to attend after their first year's service, and by the regimental schools for non-commissioned officers, thanks to which, many a youth who joins utterly without education gains sufficient knowledge to qualify him for the post of non-commissioned officer, and not a few make sufficient progress to gain admission to the Cadet schools and to pass the Officers' examination.

Still the great majority remain at a very low level as to education—an evil which is, however, less detrimental than it might be to efficiency, in consequence of the natural quickness and intelligence of the Russian peasant, combined with adroitness in all manual labour, particularly in carpentering and spade-work; besides which, he is, as a rule, willing, amenable to discipline, hardy to an extreme, brave and devoted to his leaders, all which qualities tend to make him one of the best soldiers in the world.

In Russia, as elsewhere, the difficulty of keeping up an efficient body of non-commissioned officers has made itself felt of late years more than in former times, partly owing to the reduced period of service, and partly to the increased advantages offered by other careers, in consequence of which few men re-engage, notwithstanding the considerable allowances and privileges to which they would become entitled by doing so; and most of the good men who get promoted to the rank of non-commissioned officer after two years' service do not retain their position as such more than a year, after which they take their discharge. There is, therefore, an idea of holding out still greater inducements for them to remain, and also of establishing non-commissioned officers' schools, after the German pattern. In the meanwhile, the peace establishment of non-commissioned officers has been much reduced, and none but re-engaged men are made sergeant-majors, quartermaster-sergeants, or sergeants, whilst the others can only become corporals, of whom there is but one per company on the present peace establishment, the three other non-commissioned officers of this grade who formerly existed being now replaced by lance or acting corporals. The reserve is amply sufficient, as far as mere number is concerned, to supply the additional non-commissioned officers required on mobilization.² The supply of Officers will be treated of separately.

Special Conditions of Service for the Grand Duchy of Finland.

The Grand Duchy of Finland was ceded to Russia by Sweden in 1809 under conditions which preserve to it its ancient constitution, dating from the year 1772, under which the right of legislation and of taxation was in the hands of a National Assembly. In 1817, however, the Emperor Alexander I formed a Senate of three members which distinctly controlled the Assembly. In 1812

¹ At the manœuvres of 1882, however, a British Officer was informed by Russian regimental Officers that only from 5 to 6 per cent. of the men could read and write.

² It is said that men who have served their time with the colours rarely return to the plough, but settle in towns.

the office of Governor-General of Finland was created, the whole executive power being vested in this officer. In 1816 the Imperial Senate of Finland was established—a body first of twelve and finally of eighteen members, nominated by the Emperor, and serving for three years. The Grand Duchy is now governed by this Senate, which takes its orders from the Emperor through a Secretary of State for Finland residing at St. Petersburg; but the National Assembly still exists, and passes laws *submitted* to it by the executive. A bill for the introduction of general service was carried in the Assembly and published in 1879.¹ It took effect from 1st January, 1881. Its general provisions are as follows:—

1. Every Finn is liable to render military service after completing his twentieth year.
2. The military force consists of active army, reserve, and general levy (Opoltchenié). According to the number drawn, a conscript is enrolled in one or other of the two former bodies.
3. The contingent is voted annually by the Senate of Finland.
4. The inhabitants of the Lappmark, in the district of Uleaborg, are excused from service until further notice.
5. Men enrolled in the active Army serve in it for three years, after which they serve two years in the reserve. Those enrolled in the reserve spend the whole five years in it, being called out for training during the first three years, or for ninety days in all.
6. Soldiers of the active Army get three months' furlough annually, and even a longer period during their third year's service.
7. The reserves are called out by order of the Emperor, communicated by the Governor-General.
8. The reserve men raise the field troops to war strength, form separate reserve divisions and cadres for the "Opoltchenié."
9. After passing through the reserve all men belong to the Opoltchenié until forty years of age.
10. The Opoltchenié is called out by imperial ukase, and can only be employed for home defence. It is formed into separate battalions, and is subject to military law when embodied. None of its members can be drafted into regiments of the active Army.
11. Regulations regarding exemptions, postponements, and volunteering are almost identical with those applicable to the rest of the empire.

The Command and Administration of the Army.

The Emperor is Commander-in-Chief. His orders are issued through the War Office, in which there are twelve departments:—

1. The War Ministry, whose head receives his orders direct from the Emperor, and is responsible for the general efficiency of the Army. He submits all matters of great importance to the sovereign, signs imperial decrees, and issues regulations. He has the right of inspecting all bodies of troops and military institutions. The War Minister is assisted by a staff of executive officers. There are in the office sections for staff diary, records and accounts, and a solicitor is attached to it.

2. The *Imperial head-quarters*, under a General Officer as Commandant, who, in the absence of the War Minister, takes the Emperor's orders and sees to their execution. A great many "General-Adjutants," unattached Generals, and other Officers belong to the *Imperial head-quarters*. Records are kept of all correspondence submitted to the Emperor in the *military chancery* which is attached to the head-quarters.

3. The War Council, presided over by the War Minister, superintends the

¹ Finland voted an army of 100,000 men; and eight "Governments" have constructed barracks, each for one battalion. In 1884 the Russian troops are to give over charge to the Finns, except at Helsingfors and Sweaborg. The Officers will be Finns, but the word of command will be given in Russian.

purchase and safe keeping of stores, decides upon all contracts, and supervises the military budget. There are eighteen members of this council, who are all nominated by the Emperor. These members form five committees :—A, for codifying the rules and regulations of the service ; B, for training and organization ; C, for military education ; D, for hospitals ; E, for prisons.

4. The High Court of Appeal in military cases, which is composed of a president (a general of the highest rank) and a number of members chosen by the Emperor.

5. The Head-quarter Staff, under a chief with two assistants who exercise a general superintendence over the performance of military duties, over the general staff, and the topographical corps. The work is divided into seven great sections :—A. Quarters and movements of troops. B. Organization. C. Promotion and retirement of Officers. D. Pay, allowances, and pensions. E. Recruiting. F. Mobilization. G. Supply. The following offices are also under the head-quarter staff :—the Staff Paymaster's Office ; the Office for Asiatic Affairs ; the Judicial Council ; the Stationery Office ; the Records ; the Topographical Department ; the Military Scientific Department ; the Department for Rail and Water Transport. All Officers in disponibility (unattached) are available for duty with the depôts, and are immediately under the chief of the head-quarter staff.

6. The Commissariat Department, under the Commissary-General, with seven sections, has the general supervision over the clothing supply and provisioning of the troops. Attached to it is a technical committee for testing the quality and collecting samples of goods ; also a record office, a statistical section, and a museum for models.

7. The Department of Artillery, under a General Field Marshal, is charged with the general administration of the artillery, and with the armament of the whole army. There are seven sections and a special artillery committee. The Michael's Artillery War School for Cadets and the Artillery Academy, now united with the Engineer Academy, are under this department.

8. The Engineer Department, under an Inspector-General, has four sections, besides the engineer committee. The Nicolas Engineer Academy, for the higher instruction of Officers of this arm, and the Nicolas Engineer War School are under this department.

9. The Army Medical Department, with an Inspector-General at its head, conducts all the medical personnel, and generally superintends all matters relating to the health of the troops. There are in this department four sections, a record office, and a medical scientific committee. The Imperial Medico-Surgical Academy at St. Petersburg is under this department.

10. The Military Education Department, under a Director-General, with assistants who superintend all military educational establishments, those for the special arms excepted. It comprises three sections, a record office and a consultative committee of professors and schoolmasters.

11. The Cossack Department, under a chief, assisted by a deputy, controls all matters relating to the Cossack troops. There are four sections and a Cossack Committee.

12. The Judge-Advocate General's Department, with four sections, has the control of the administration of military law and the superintendence of the Academy of Military Law.

The Inspector-General of Cavalry, with his staff and officers, and the Inspector of Musketry are also attached to the War Ministry.

Army Administration in Peace and War.

The Russian Empire is divided into fourteen general governments (including the "Province of the Cossacks"), each of which is a military district. The "General Governor" is not only the principal civil official, but also commands all the troops in his district. Under him is the *District Military Council*, which is a sort of district War Office, and serves as channel of communication

between the General Governor and all the troops, field, reserve, and local, under his command. The General Governor is president of the Council, the members being the chiefs of the six departments of the district staff, the General Governor's assistant, if there be one, and a member nominated by the War Minister. Questions are decided by a majority of votes; but the president may act on his own responsibility, if he thinks fit, pending instructions from head-quarters. The Council deals with matters of finance, and the president has power to conclude contracts under certain restrictions.

Army Corps.

Up to 1876 the largest tactical unit in the field Army was the Division, to which belonged four infantry regiments, each of three or four battalions, and a brigade of artillery. The Cavalry was in like manner formed in Divisions and was only combined with Infantry in war time—a rule which applied also to the Engineers. Divisional Commanders were responsible to general governors for the tactical instruction of their Divisions. Since 1876 groups of two or more Infantry divisions, together with the Artillery brigades attached to them, and with a Cavalry Division, have been united into Army Corps. This system, which prevailed throughout the Russo-Turkish war, was made applicable in peace time also to the whole Army, except to the Finland Division and to three of the Caucasus Divisions.

There are now, in all, nineteen Army Corps, of which seventeen in European Russia and two in the Caucasus.

An Army Corps, as a general rule, includes only two Divisions of Infantry and one of Cavalry. Five Army Corps, however, have three Divisions of Infantry, and one Army Corps has two Divisions of Cavalry, whilst two Army Corps have no Cavalry.

The normal strength and composition of an Army Corps on the war footing are as follows:—

	Com- batants.	Non- Com- batants.	Total Men.	Horses.	Guns.
Staff of an Army Corps	16	35	51		
„ Two Infantry Divisions	10	24	34		
„ Four Infantry Brigades	4	—	4		
„ Two Field Artillery Bri- gades	6	44	50		
„ One Cavalry Division	4	11	15		
„ Two Cavalry Brigades	2	—	2		
Two Infantry Divisions	31,568	936	32,504	1,488	
Two Field Artillery Brigades	2,904	288	3,192	3,192	96
One Cavalry Division ¹	2,976	364	3,340	2,824	
Two Horse Artillery Batteries	370	52	422	460	12
One Rifle Battalion	981	44	1,025	61	
Engineers	1,871	337	2,208	1,233	
Two Divisions Flying Artillery Trains	1,424	196	1,620	1,828	} 700 vehicles.
One Cavalry Flying Artillery Park Section	142	19	161	177	
¼ Rifle Flying Artillery Park Section	25	5	30	32	
Two Divisional Ambulances	—	446	446	460	
Total	42,303	2,791	45,094	10,755	108

700 vehicles, besides those of the batteries.

When the contemplated increase to Cavalry and Horse Artillery has been fully carried out, the strength of the Cavalry Division will presumably be about as

This Table has been extracted from "Armed Strength," and slightly altered, in consequence of changes made since that book was published.

The Commanders of Army Corps are under the General Governors, like the Divisional Commanders of old, but have rather more power than the latter used to have; they have not, however, in peace time, anything like the importance and authority possessed by German Officers in a similar position; a certain individuality, however, begins to show itself in particular corps, arising probably more from the personal influence of the Commander than from any other cause. The late General Skobelev's Army Corps was a remarkable instance of this. The local troops, including hospital and recruiting departments, were formerly under a special chief, who was responsible to the General Governor. Under this chief, again, were various military officials and a mixed commission of military and civilians which managed the details of recruiting and mobilization. The reorganization of 1881 abolished almost all the local military Officers, and divided the whole empire *for recruiting purposes* into twenty-two local brigade districts of unequal size, each under command of a Brigadier having the powers of an independent Divisional General over the local reserves and depôts. The subordinate Officer next in rank to the local Brigadier is the Military Commander of the district. The new organization does away altogether with one grade in the old military hierarchy—that of Chief of the local troops of the district, and, moreover, reduces the number of local Commanders by more than two-thirds, substituting, as it does, twenty-two local Brigadiers for sixty-nine district Chiefs.

In the Don Cossack province the old system is still in force. In Finland the duties of the local Brigadier are performed by the district Chief of the Staff, and on that Officer or on his assistant devolves the duty of inspecting the military hospitals in all the districts.

Command in the Field.

When war breaks out, an army is formed of two or more Army Corps. The Commander-in-Chief only exercises supreme authority in the military districts where the Army is operating by special decree of the Emperor, failing which the several General Governors retain their power. The prerogatives of the Commander-in-Chief are strictly defined. Through his staff he controls all the arrangements made by the military officials of the districts for the subsistence of his army. If it penetrates into the enemy's country, he exercises the chief authority, civil and military, in the occupied territory. He has on his staff, in addition to the usual military officers, a field "ataman" of Cossacks to command all (so-called) irregulars not attached to any division; one of the principal officers of the Judge-Advocate's department for legal questions; an official from the Foreign Office for diplomatic business; a commissary to administer the occupied territory; a number of officers of various ranks for special duties; and, if in the country of an ally, a commissioner to represent it. The head-quarter staff of the Army is organized in the same manner as those of the War Office and of the different military districts; that is to say, it is composed of a "Field Staff" for purely military operations, which consists of a Chief of the Staff, who is second in command, with his usual subordinate departments, of a "Field Commissariat," and of a "Staff for the line of Communication." The Chief of the Staff has control over the military police, the medical department, including hospitals and auxiliary ambulances, the field post, the chaplain's department, the park of the Army (under immediate command of the Officer commanding the Artillery), the commissariat follows:—Combatants, 4,400; non-combatants, 400; total men, 4,800; horses, 4,200; whilst there will be three Horse Artillery batteries with a total strength of—combatants, 555; non-combatants, 78; total men, 633; horses, 690; guns, 18. The strength of the Army Corps will then be about—combatants, 43,912; non-combatants, 2,853; total men, 46,765; horses, 12,361; guns, 18.

train (under the Commissary-General), the heads of the different branches of the service of communication—that is to say, of the system of stations along the lines of communication (*étappen*), of railway management (including command of the railway battalions and sections of workmen), and of post and telegraph offices. To all these departments belong a great number of officers and officials of every grade, including many attached “for particular service.” The staff of army corps, Divisions, or smaller bodies, temporarily or permanently detached from the main army are similar, in due proportion to strength and the requirements of the moment, to the head-quarter staff of the Army.

Staff Establishments of an Army in the Field.

Head-quarter Staff.

Commander-in-Chief.

Officers attached to his person, besides those already mentioned.

Aides-de-camp.				Special Officers.			
Field Officers	....	....	3	Generals	....	....	2
Other Officers	....	....	3	Field Officers	....	....	2
				Other Officers	....	....	2

I.—Staff of the Army.

Chief of the Staff ....				....	....	....	....	1	
Aides-de-camp	2	Assistant ²	....	....	....	1
(one of whom a Field Officer)					Chief of Topographical Section				
Sub-Chief of Staff	2	(Major-Gen. or Colonel)	....	....	....	1
Field Officers in Charge of Sections	4	Assistant	....	....	....	1
Assistants ¹	4	Officers in Topographical Dept.	....	....	....	5
Military Officials (senior)	4	Attached for Duty ¹	....	....	....	6
"	"	(junior)	....	4	(one of whom a General and two				
					Field Officers)				
Chief of Office	{	Colonel or Maj.-			Officials in Accountant's Office	....	....	....	10
		General	....	1	Clerks	....	....	....	36
Assistant	1	Officials in Topographical Dept.	....	....	....	12
Field Officer in charge of Guides				1	Officials in Printing Office, &c.	....	....	....	22

Establishments subject to the Chief of the Staff.

Commandant at Head-quarters Office.

Officers, 4 (of whom 1 Major-General and 2 Field Officers); Officials, 8.

Inspector of Hospitals' Department.

Officials 10

Field Sanitary Service.

Medical Officers, 13 (including one V. S.); Officials, 14

Medical Reserve.

Medical Officers, 131 (including ten V. S.); Officials, 55

Field Post.

Officials 16

Chaplain-General's Department.

Clergymen 2 | Officials 5

¹ Half of these Officers belong to the Staff Corps.

² Belonging to the Staff Corps.

II.—*Commissariat.*

Officers	3	Officials	105
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III.—*Artillery Department.*

Commanding Officer of Artillery (General or Lieut-General)	1
Attached Officers (of whom 1 Major-General and 1 Field Officer)	5
Assistant to Commanding Officer (Lieut-General or Major-General) ...	1
Senior Aides-de-camp (Field Officers)	2
Officials	16

IV.—*Engineer Department.*

Commanding Officer of Engineers (General or Lieut.-Gen.)	1
Attached Officers (of whom 1 Field Officer)	4
Assistant to Commanding Officer (Lieut.-General or Major-General)	1
Senior Aides-de-camp (Field Officers)	2
Assistants	5
Officials, &c.	10
Drivers	4

V.—*Service of Communications.*

Director-in-Chief (General or Lieutenant-General)	1
Attached Officers	<div style="display: inline-block; vertical-align: middle;"> <div style="display: inline-block; vertical-align: middle;"> <div style="display: inline-block; vertical-align: middle;">1 Major-General</div> <div style="display: inline-block; vertical-align: middle;">1 Field Officer</div> <div style="display: inline-block; vertical-align: middle;">2 other Officers</div> </div> <div style="display: inline-block; vertical-align: middle; font-size: 2em;">}</div> <div style="display: inline-block; vertical-align: middle;">4</div> </div>

Branches of the Service of Communications.

- A. Stations—1 Chief (Lieut.-General or Major-General) ; 2 Heads of Sections ; 29 Officials.
- B. Communications—1 Chief (Lieut.-General or Major-General) ; 2 Heads of Sections ; 20 Officials.
- C. Post and Telegraphs—1 Chief (Lieut.-General or Major-General) ; 2 Heads of Sections ; 22 Officials.
- D. Office—1 Chief (Colonel) ; 2 Heads of Sections ; 18 Officials.

VI.—*Field Ataman's Department.*

Field Ataman (Lieut.-General)	1
Field Officer Attached	1
Senior Aide-de-camp	1
Clerks....	4

Personal Escort.

Captain Commanding	1	Dresser	1
Subaltern	1	Farrier Sergeant	1
Sergeant-Major	1	Artificers	3
Quartermaster Sergeant	1	Train—	
Non-commissioned Officers	7	Non-commissioned Officers	2
Lance-corporals	10	Privates	48
Privates	40		
Combatants	61	Non-combatants	55

Staff of an Army Corps.

Army-Corps Commander (General or Lieut.-General), 1.

Chief of the Staff (Major-General or Colonel)	1	Officer Commanding Corps-Artillery	1
Senior Aides-de-camp	2	Commandant at Head-quarters ¹	1
Field Officer Attached	1	Officer in charge of Train ¹	1
Aides-de-camp to Corps Commander	2	Staff Surgeon	1
Other Officers (attached)....	2	Chief Commissary of Corps	1
Commanding Officer of Corps-Engineers	1	Officials, &c.	10
Assistant-Engineer (2 if there are three Divisions)....	1	Train ¹ —	
		Non-commissioned Officer	1
		Privates	3

Staff of the Officer Commanding Corps-Artillery.

Lieut.-General Commanding	1
Aides-de-camp	2
Assistant to Senior A.D.C....	1
Clerks	4
Driver	1

Commissariat Establishment.

Officials, Clerks, &c....	13
Driver	1

Staff of a Division.

Lieutenant-General Commanding, 1.

Chief of the Staff (Colonel or Lieutenant-Colonel)	1	Divisional Surgeon	1
Aides-de-camp	2	Staff Bugler ³	1
Divisional Engineer Officer ²	1	Clerks	8
		Drivers ⁴	3

Staff of a Brigade.

Major-General Commanding, 1.

Aide-de-camp	1	} Only with Rifles. Not with Line Infantry or Cavalry.
Clerks	5	
Driver	1	

Staff of a Brigade of Field Artillery.

Major-General Commanding, 1.

Aide-de-camp	1	Clerks	6
Treasurer and Quartermaster	1	Dressers	7
Surgeon and Assistant	2	Overseer of Sick	1
Veterinary Surgeon	1	Armourer	1
Riding-Master	1	Drivers ⁵	2
Staff Trumpeter	1		

¹ Only in war.² Only when the Division is independent. No Divisional Engineer with Cavalry Division.³ No staff bugler with Cavalry Division.⁴ 1 driver only in peace with Infantry or Cavalry Division ; 4 drivers in war, with litter.⁵ Only one in time of peace.

The Land Forces of Russia.

The Land Forces of Russia consist of—

I.—The regular troops, which comprise—

1. The Field or Standing Army.
2. The Reserve.
3. The Depôts.
4. Fortress and Local Troops.
5. Special Corps.

II.—The irregular troops, comprising—

1. The Cossacks.¹
2. Militia of the Caucasus.

III.—The Opol'tchenié, which is composed of all men capable of bearing arms, between the ages of 20 and 40, who do not belong either to the regular or to the irregular troops.

The Field or Standing Army is divided into *Guards*, *Grenadiers*, and *Line*, each comprising Infantry, Cavalry, Artillery, and Engineers.

The different arms are distributed as follows:—

Infantry.

	Regiments.	Battalions.
Body Guard	10	= 40
Grenadiers of the Guard	2	= 8
Grenadiers	12	= 48
Grenadiers of the Caucasus	4	= 16
Line	164	= 656
Rifles of the Guard	—	— 4
Rifles of the Line (including 8 Finland Battalions and 6 Transcaspian Battalions, also 12 Battalions in Caucasus, Turkestan, and Siberia)	—	— 46
Frontier Infantry (Caucasus; Siberia, E.; Siberia, W.; Turkestan)	—	— 36
Total Infantry	192	= 854

Cavalry.

	Regiments.	Service Squadrons.
Cuirassiers of the Guard	4	= 16
Mounted Grenadiers of the Guard	1	= 4
Dragoons of the Guard	1	= 4
Lancers of the Guard	2	= 8
Hussars of the Guard	2	= 8
Dragoons of the Line ² (including 4 Regi- ments in the Caucasus)	46	= 184
Total	56	= 224 ³

¹ There are now a good many Cossack regiments on the establishment of the regular army; so that the designation "irregular" is no longer universally applicable to Cossack troops.

² Until very lately, the Cavalry of the Line consisted of 18 Regiments of Dragoons, 14 of Lancers, and 14 of Hussars; but by an Imperial decree, dated August 30th, 18 2, the Lancers and Hussars of the Line were transformed into Dragoons; the only representatives of the two former descriptions of Cavalry, as well as of the Cuirassiers, being now found in the Guard.

³ With the new organization, when completed, there will be six service squadrons to each regiment, or 336 service squadrons in all.

Cossack Cavalry.

				Regiments.	Squadrons.
Cossacks of the Guard	....	....	....	2	= 12
(4 Squadrons of each Regiment are on furlough in peace time, leaving 2 Squadrons per Regiment, which are formed into one Regiment.)					
Ural Cossacks	....	....	....	—	— 1
Don Cossacks	....	....	....	20	= 120
Kuban Cossacks	....	....	....	7	= 42
Terek Cossacks	....	....	....	2	= 8
Total Cossack Cavalry	....			31	= 183
Grand total Cavalry	....			87	= 407 ¹

Artillery.

				Batteries.			Number of Guns.
				Heavy, 4·2 in.	Light, 2·42 in.	Mountain, 2·5 in.	
Field Artillery of the Guard	....			9	9	—	144
" " Grenadiers	....			11	13	—	192
" " Line	....			119	122	15	2,048
Horse Artillery of the Guard ²	....			—	5	—	30
Cossack " " "	....			—	1	—	6
Horse Artillery of the Line ²	....			—	21	—	126
Cossack " " "	....			—	12	—	72
Turkestan Battery	....	....	....	—	—	1	8
W. Siberia " "	....	....	....	—	—	1	8
Total Field, Horse, and } Mountain Artillery }				139	183	17	2,634

Engineers.

				Battalions.	Companies.
Sappers of the Guard	....	....	....	1	= 4
Grenadier Sappers	....	....	....	1	= 4
Sappers of the Line	....	....	....	13	= 52
Turkestan Sappers	....	....	....	$\frac{1}{2}$	= 2
East Siberian Sappers	....	....	....	—	1
Railway Battalions	....	....	....	4	= 16
Pontoniers (Half-Battalions)	....	....	....	8	= 16
Torpedo Companies	....	....	....	—	4
Total Engineers	....			23 $\frac{1}{2}$	99

Grand Total of the Field Army.

Infantry, Battalions	....	852		
Cavalry, Regiments	....	87		
Artillery, Batteries	....	339	Guns	2,634 ²
Engineers, Companies	....	99		

¹ The grand total of service squadrons, when the new formations are complete, will be 519.

² When the new batteries are completed, there will be probably 42 guns of the Horse Artillery of the Guard and 180 guns of the Horse Artillery of the Line; and the total number of guns in the Field Army will be 2,700.

THE DIFFERENT ARMS.

Infantry.

The twelve regiments of the Guard are distinguished by titles and honorary designations. Grenadier regiments are numbered from 1 to 16; and line regiments from 1 to 164. Each regiment has, besides its number, a local title, taken from the town which is usually its head-quarter station in time of peace; and many regiments also bear honorary designations.

The four rifle battalions of the Guard have the following titles:—1. The Emperor's. 2. Tsarskoe Selo. 3. Finland. 4. The Imperial Family's.

The twenty European rifle battalions of the line are numbered consecutively; so also are those of Finland, and those of the Caucasus and of the different Asiatic districts, each independently.

The frontier battalions are divided into four groups (Caucasus, Turkestan, East Siberia, West Siberia), in each of which there is a separate numbering.

TACTICAL AND ADMINISTRATIVE ORGANIZATION.

The *Company* is the smallest tactical and administrative unit. Its establishment is now the same in all Infantry battalions, whether of the Guard, Grenadiers, Line, or Rifles; namely, *in peace-time*—

Officers : Captain, 1 ; Lieutenant, 1 ; Sub-Lieutenant, 1	....	3
Non-commissioned Officers : Sergeant-major, 1 ; Quartermaster-sergeant, 1 ; Sergeants, 4 ; Corporal, 1	....	7 ¹
Volunteers (candidates for commissions)	....	2 ²
Drummers	....	2 ³
Privates (with arms), of whom 10 Lance-corporals	....	96
Ditto (without arms)	....	4 ⁴
Total, all ranks	....	114

In war-time—

Officers : Captain, 1 ; Lieutenant, 1 ; Sub-lieutenant, 1 ; Ensign, 1	....	4
Non-commissioned Officers : Sergeant-major, 1 ; Quartermaster-sergeant, 1 ; Sergeants, 4 ; Corporals, 14	....	20
Volunteers	....	2 ²
Drummers	....	2 ³
Hospital orderly	....	1
Privates (with arms), of whom 20 Lance-corporals	....	200
Ditto (without arms)	....	15 ⁵
Total, all ranks	....	244

¹ Reduced from 10 by Imperial order of 12th September, 1881.

² Reduced from 4 by same order. Two additional volunteers, however, may be borne on the strength, serving at their own expense.

³ The buglers formerly on the strength of companies in Grenadier regiments were reduced by the same order. Men are now taken from the ranks to act as buglers, two per company, one of whom also acts as marker. The regiments of the Guard and the Rifle battalions still have two buglers per company on their strength. "Battalion" drummers and buglers were struck off.

⁴ These men are employed as Officers' servants.

⁵ Employed as cooks, orderlies, and Officers' servants.

The Company is divided into four *divisions*,¹ each of which is under a first-class Non-commissioned Officer for purposes of interior economy. Each division is subdivided into two *sections* ("Otdjalenie") in peace time; into four *sections* in war time. These sections are under second-class Non-commissioned Officers for interior economy; or rather at the present time, owing to the great reduction in the establishment of Non-commissioned Officers, under Acting or Lance-corporals. Each subaltern Officer superintends two divisions for interior economy, and commands a division in the field. The ensign (answering to the German Portepéefähndrich) does duty as an Officer. Four companies form a battalion. The battalion commander (a Lieutenant-Colonel or Major) and the captains of companies occupy the same relative position as in the German army; that is to say, the former exercises only a general supervision and control over the latter, who are directly responsible to him for the training, discipline, and general condition of their men. The commander of an independent battalion has the powers of a regimental commander.

ESTABLISHMENT OF A BATTALION OF INFANTRY.

Combatants.

Officers.						Peace.	War.
Battalion Commander—Lieut.-Colonel or Major	....					1	1
Company Commanders—Captains half, 2nd Captains half	....	....	....	....	....	4	4
Adjutant	....	....	....	....	....	1	1
Subalterns—Lieutenants, Sub-Lieutenants, and Ensigns	....	....	....	....	....	8	12
Total Officers						14	18
Non-commissioned Officers and Privates—Company							
Sergeant-Majors	....	....	....	....	....	4	4
Company Quartermaster-Sergeants	....	....	....	....	....	4	4
Non-commissioned Officers—1st Class, Sergeants	....					16	16
" " 2nd Class, Corporals	....					4	56
Drummers	....	....	....	....	....	8	8
Lance-corporals	....	....	....	....	....	40	80
Privates	....	....	....	....	....	360	780
Volunteers	....	....	....	....	....	8	8
Total Non-commissioned Officers and Privates						444	948
Total Combatants						458	966

Non-Combatants.

Classed as Officers.						Peace.	War.
Surgeons, 2nd Class	....	....	....	....	....	1	1
Total classed as Officers						1	1

¹ This word being used in two senses, first to denote a body composed of several regiments of cavalry or infantry, secondly (as in the present case), a certain portion of a company, of a squadron, or of a battery, in order to distinguish between the two meanings, a capital *D* will be prefixed in the first case, and a small *d* in the second case, throughout this paper.

Classed as Officers.					Peace.	War.
Other ranks—Clerks, 1st Class	....	....	....	....	1	1
" 2nd Class	....	....	....	....	1	1
Hospital Assistants, 2nd class	....	....	....	....	1	1
" " Company	....	....	....	....	4 ¹	0
Dressers	....	....	....	....	4	4
Drivers	....	....	....	....	3	12
Total Non-combatants					15	20
Add total Combatants					458	966
Grand total per battalion					473	986

Horses.

<i>Chargers</i> —	Commanding Officer	....	....	....	....	1	1
	Adjutant	....	....	....	....	1	1
	Captains	....	....	....	....	0	4
<i>Draught</i>	....	....	....	....	....	6	42
						<hr/>	
	Total horses	....	....	....	....	8	48

N.B.—The establishment of the Guard and Grenadier regiments differs slightly from that of the Line regiments in the number of musicians and of non-combatants, but the difference is hardly worth recording.

ESTABLISHMENT OF A RIFLE BATTALION.

Combatants.

Officers :		Peace.	War.
Battalion Commander—Colonel, Lieut.-Col., or Major		1	1
Second Field Officer—Major	.... .	1	1
Company Commanders—1st Captains	.... .	2	2
" " 2nd Captains	.... .	2	2
Adjutant	.... .	1	1
Paymaster and Quartermaster	.... .	1	1
Arms—Officer	.... .	1	1
Subalterns	.... .	8	12
Total Officers	.... .	17	21

Non-Commissioned Officers and Privates :

Sergeant-Majors (Company)	4	4
Quartermaster-Sergeants (Company and Battalion)	6	6
Sergeants	16	17
Corporals	4	56
Drummers or Buglers (Battalion)	1	1
" " (Company)	8	8
Lance-corporals	40	80
Privates	360	780
Volunteers	8	8
 Total Non-commissioned Officers and Privates	 447	 960
 Total Combatants	 464	 981

¹ Attached to the hospitals in war-time.

<i>Non-Combatants.</i>							Peace.	War.
Classed as Officers :								
Surgeons (1st Class)	....	....	....	....	....	....	1	1
„ (2nd Class)	....	....	....	....	....	....	1	1
Accountant ....	....	....	....	....	....	....	1	1
Total classed as Officers							3	3
Other ranks :								
Clerks { Battalion	....	....	....	....	....	....	1	1
1st Class	....	....	....	....	....	....	2	2
2nd Class	....	....	....	....	....	....	2	2
Dressers { 1st Class	....	....	....	....	....	....	1	1
2nd Class	....	....	....	....	....	....	1	1
Company	....	....	....	....	....	....	4	4
Veterinary	....	....	....	....	....	....	4	1
Acting Dressers ¹	....	....	....	....	....	....	4	0
Inspector of Sick	....	....	....	....	....	....	1	1
Hospital Orderlies	....	....	....	....	....	....	2	2
Master Armourer	....	....	....	....	....	....	1	1
Cutter and Fitter	....	....	....	....	....	....	1	1
Tradesmen	....	....	....	....	....	....	6	8
Drivers ²	....	....	....	....	....	....	4	16
Total other ranks							30	41
Total Non-combatants							33	44
Add total Combatants							464	981
Grand Total							497	1,025

Horses.

Chargers	....	....	....	....	....	....	1	1
Baggage	....	....	....	....	....	....	8	60
Total							9	61

Four battalions form a regiment under a Colonel (in the Guard, a Major-General).

ESTABLISHMENT OF A REGIMENT.

Combatants.

Officers :							Peace.	War.
Regimental Commander	....	....	....	....	....	....	1	1
Battalion Commanders	....	....	....	....	....	....	4	4
Extra Field Officers (Majors)	....	....	....	....	....	....	2	2
Captains { commanding	....	....	....	....	....	....	8	8
Second Captains { Companies	....	....	....	....	....	....	9	9
Regimental Adjutant ³	....	....	....	....	....	....	7	7
Treasurer and Quartermaster	....	....	....	....	....	....
Officer in charge of the Arms	....	....	....	....	....	....
Four Battalion Adjutants	....	....	....	....	....	....
Subalterns	....	....	....	....	....	....	32	48
Total Officers							63	79

¹ Attached to hospitals in war.

² In the Frontier Battalions there are 13 drivers in peace time, and 44 in war time.

³ A Captain (2nd Class).

Non-commissioned Officers and Privates :						Peace.	War.
Sergeant-Majors	{	1 Regimental	....	....	....	17	17
		16 Company	....	....	....
Quartermaster-Sergeants	....	....	....	....	....	19	19
(3 in Regimental and 16 in Company employ)							
Non-commissioned Officers	{	Sergeants, ¹ 1st Class	....	....	....	65	65
		Corporals, ² 2nd Class	....	....	....	16	223
Musicians	{	ranking as Non-com-	1st Class, Sergts.	....	....	1	1
		missioned Officers	2nd Class, Corporals	....	....	10	10
		Privates	....	....	....	24	24
Drummers, Regimental	....	....	....	....	....	1	1
„ Company	....	....	....	....	....	32	32
Bugler, Regimental	....	....	....	....	....	1	1
Lance-corporals	....	....	....	....	....	160	320
Privates	....	....	....	....	....	1,440	3,120
Volunteers	....	....	....	....	....	32	32
Total Non-commissioned Officers and Privates						1,818	3,867

Total Combatants 1,881 3,946

Non-Combatants.

Classed as officers :

Surgeons, 1st class	....	....	....	....	....	1	1
„ 2nd class	....	....	....	....	....	4	4
Paymaster	....	....	....	....	....	1	1
Chaplain	....	....	....	....	....	1	1
Total	....	....	....	....	....	7	7

Other ranks :

Clerks	{	Regimental	....	....	....	....	1	1
		1st class	....	....	....	....	4	4
		2nd class	....	....	....	....	5	5
Hospital Assistants	{	1st class	....	....	....	....	1	1
		2nd class	....	....	....	....	4	4
		Apothecary	....	....	....	....	1	1
		Company	....	....	....	....	16	16
		Veterinary Surgeon	....	....	....	....	1	1
Dressers ³	....	....	....	....	....	....	16	0
Superintending the Sick	....	....	....	....	....	....	1	1
Hospital Orderlies ⁴	....	....	....	....	....	....	3	0
Sacristan	....	....	....	....	....	....	1	1
Master Armourer	....	....	....	....	....	....	1	1
Master Tailor	....	....	....	....	....	....	1	1
Tradesmen ⁵	....	....	....	....	....	....	10	18
Drivers ⁶	....	....	....	....	....	....	12	48

Total Non-Combatants 86 117

Total Combatants 1,881 3,946

Grand Total 1,967 4,063

¹ One of them has charge of the transport.

² One of them attached to the transport in war.

Attached to the hospitals in war.

⁴ Increased to 10 in peace time, when the regimental hospitals are open.

⁵ The proportion of the different kinds of tradesmen is fixed by the Colonel.

⁶ The regiments of the Caucasus have 65 drivers in war time, and 249 draught horses.

Horses.

Draught ¹	24	201
Chargers (including one for Regimental Bugler)	13	31
Total Horses	37	232

Of the two extra Majors who form part of the regimental staff, one assists the Commanding Officer in his general duties, whilst the other is at the head of the regimental workshops and has charge of the funds. Besides the Officers mentioned in the regimental establishment as forming part of the regimental staff, there are several subalterns attached to it who are nevertheless on the strength of companies—

1. An Officer to visit the regimental hospital.
2. One charged with the supervision of the regimental school.
3. A commandant of the non-combatants (tradesmen and drivers).
4. A regimental marker.
5. A court-martial secretary.

The regimental adjutant has charge of the band.

The following table shows the difference between the present and former (previous to 1881) strength of an infantry regiment :—

	Officers.	Volunteers.	N.-C. Officers.	Drummers, &c.	Privates.	Total combatants (including Officers' servants).
Present war footing	79	32	326	32	3440	3911 + in addition 35-55 musicians.
Former	80	64	320	38	3600	4102
Present peace footing	63	32	117	34	1600	1846 + in addition 35-55 musicians
Former	64	64	160	38	1600	1926

Two regiments (eight battalions) form a Brigade under the senior regimental commander, who has no permanent staff nor office allotted to him. An Officer detached from one of the regiments does the office work of the brigade in one of the regimental orderly rooms. Organization by brigades is a novelty in the Russian service, and in peace time is almost a dead letter except for field exercise.

Two brigades, with the addition of an artillery brigade, form a *Division*, which even now, since the introduction of the *army-corps* organization, is considered by the Russians to be the handiest of the larger units; and, in truth, an infantry Division of sixteen battalions (12,000-16,000 combatants), with in addition one or two battalions of *Rifles*, its quota of forty-eight guns, one or two companies of engineers, and a due proportion of cavalry, is quite capable of carrying out an independent operation on a considerable scale. Smaller detachments are formed of an infantry brigade with one or two batteries and one or two squadrons.

Infantry Tactics.

After a long and warm controversy between the two schools of tactics, namely, that which adhered to the old bayonet tactics naturalized by Suwarow, and that which especially favours fire tactics, the latter school gained the

¹ The regiments of the Caucasus have 65 drivers in war time, and 249 draught horses.

ascendency, and, in Russia as elsewhere, it was recognized that infantry fire had become the most important factor in modern warfare, offensive as well as defensive. The bayonet school, however, was not thoroughly put out of court till after the war of 1877-78, a mass of evidence being then produced which could not fail to convince even the most obstinate defenders of the old system. Even before the war, indeed, the new idea had spread so far as to lead to the appointment of a Commission which drew up some new "rules for training the company and the battalion for war," and the army was called upon to try the innovations therein recommended. After the war these experiments were continued with the advantage of the light thrown upon them by the experience gained in Turkey, resulting in a new edition of the *Field Exercise Book*, in four parts, which was commenced in the winter of 1879-80, and completed in March, 1881. This work, with a supplement on the conduct of troops in battle, is now the text-book for the Russian infantry. We will notice its most remarkable points.

1. The training of soldiers, both individually and collectively, as skirmishers is recognized as the most important part of infantry instruction.

2. With a view to better fire-discipline, a distinction is made between "slow" and "rapid" fire which did not previously exist. The Officer points out the object to be aimed at, and names the distance. The practice of ordering a certain number of rounds to be fired is introduced, as is also that of volley-firing with the use of various sights at the same time.

3. When a section extends, the distance between men is not to exceed two paces. The smallest link in the chain is now the non-commissioned officer's party of six files. No interval is, as a general rule, kept between these links.

Theoretically, skirmishers are kept under control even more than men in close order, no individual initiative being allowed. Units, from the smallest upwards, may be intermingled without regard to their proper position in the battalion; but each unit must be kept intact. Bugle sounds are reduced to a minimum. The whistle is used to call attention. Skirmishers rally on their own company reserve, and every company covers its own front. Battalions in the first line are usually formed for battle in two lines, each composed of two companies in line of company columns with small intervals. Each company in the front line then throws out skirmishers, and forms its own reserve; the two companies in the second line forming the battalion reserve.

The amount of interval between skirmishers depends upon circumstances, but, as a general rule, a company extended is supposed to occupy a front of 250 paces; that is to say, 500 paces are allowed for the front of a battalion, or 1.16 pace per man. It rests, according to regulation, with the commander of the battalion to determine how many divisions per company are to be extended when skirmishers first move out at the beginning of an attack on an enemy in position; and it is usual for each of the divisions told off for this purpose to send a small patrol 300 paces in advance, to cover its front, when the enemy is still some 2,000 paces distant, so as to postpone its complete extension as long as possible. In wood-fighting, companies keep up their communication with one another by means of similar patrols. The chain of skirmishers pushed forward by the companies in first line should be reinforced to the full strength desired when 800 paces from the enemy, the company reserves keeping, when on open ground, 500 paces behind them; the battalion reserves are 500 paces further to the rear. The formation of these reserves will depend upon the nature of the ground, and the amount of fire brought to bear upon them. If the ground be open, and the fire heavy, line formation with open files will be adopted. The advance will be as uninterrupted as possible, the skirmishers, however, halting, when advisable, to fire. The expenditure of ammunition should be carefully watched, so as to reserve as much as possible for close quarters. Seven rounds in two minutes

should never be exceeded at this stage of the combat, which is called the *zone of advance*.

At 800 paces from the enemy, the assailants are supposed to enter the *zone of attack*, which extends to within from 300 to 150 paces from the enemy, or, it may be said, to the most advanced point at which it may be possible to gather for the final rush. During this, the second stage of the affair, the skirmishers advance by rushes of alternate divisions, the company reserves gradually closing up, so as to join them when they come to their last halt, remaining themselves, however, in compact formation, the battalion reserves closing gradually upon the fighting line, which increases its fire to the utmost. Now comes the final stage of the affair, called the *bayonet charge*. The skirmishers, followed closely by the company reserves, advance on the enemy with drums beating. At about 50 paces from the position the word is given to cheer and charge. On gaining the position, the reserves, if still in hand, fire volleys on the retreating enemy, who, as a general rule, must on no account be pursued except by fresh troops, if any should happen to be available, or by those which have just attacked, only after they have been rallied and re-formed.

In treating of a defensive action, great stress is laid upon proper occupation and entrenchment of the position ; upon securing the flanks ; upon measuring the distances of surrounding objects ; upon making a vigorous sally at the right moment, if possible from a flank of the position.

Bodies of troops engaged with the enemy are not to expect relief, but must hold their ground to the last.

The arrangements for keeping up the supply of ammunition are as follows. There are 16 ammunition wagons allotted to each infantry regiment, and 4 to each rifle battalion. At the commencement of an action, one wagon moves up to the rear of each infantry battalion, and two wagons to the rear of each rifle battalion engaged, each wagon under charge of a non-commissioned officer. On open ground they remain about 1,000 paces behind the fighting line ; if there is good cover, they take advantage, and push forward as far as can be done with security. Two men are told off in each company of the fighting line, for the purpose of bringing up ammunition from the wagons when ordered to do so. At critical moments, wagons may even drive right up to the combatants.

Ammunition wagons carry white flags by day and green lights by night.

The retreat of a body of infantry in close proximity to the enemy is carried on, if not hardly pressed, in the same manner as the second stage of the advance, by alternate rushes, covered by the fire of the halted parties ; but if the enemy pursues vigorously, no fixed rules are given, except that all commanding positions on the line of retreat must be occupied, and that sudden offensive returns should be made to check the enemy. Cavalry attacks may be received in any formation whatever. The chain of skirmishers and the reserves only draw towards one another for mutual support if the ground is open, and if there is plenty of time to make the movement without undue hurry. The skirmishers then form groups, and the reserves are placed in *échelon* to these groups. If the reserve is in column, the front divisions deliver their fire from the knee. In order to accustom foot-soldiers to horsemen, and *vice versa*, cavalry are made to charge through partially extended infantry ; and in the absence of cavalry, parties of mounted Officers, of whom there are from 8 to 12 in each infantry regiment, are used for this practice.

Infantry and artillery are worked together a great deal, and the former are taught that, when guns are lost, the disgrace of the loss falls upon the body of infantry which was nearest to them, and which should take as great care of them as if specially detached to escort them. If guns are occupying commanding ground, skirmishers should always be extended in front of them, and their reserves behind or on the flank of the battery. The practice

formerly in vogue of training infantry and cavalry soldiers as gunners, so as to reinforce the latter at need, has been abandoned, partly on account of the shortened service of infantry, and partly on account of the strength of the battery establishments.

And now a few words as to drill and formation in close order, which have been much simplified.

The cadence in marching is now from 116 to 120 paces per minute, whereas formerly it was only from 112 to 116.

The touch is looser in the ranks than formerly. Whereas by the old regulations three fingers' breadth was allowed between files, a whole hand's breadth is now allowed, and the rear rank is now supposed to be the length of a man's arm from the front rank. The position of the soldier is easier and less constrained. The manual exercise has been simplified. Double columns are done away with. Open column and line formation of the battalion are only retained for parade purposes. Squares to resist cavalry are no longer used, as it is held that infantry should hold their own in any formation against horsemen. Company drill is simplified. Battalions are now formed either in close column of companies, half companies, sections and half sections, in column by companies (*i.e.*, mass of company columns), or in line of company columns (a very handy preparatory and manœuvring formation). In changes of front companies move independently, and by the shortest line, to their new ground. In brigade movements the usual formation of a battalion is the close column of half companies. There are no drill regulations for a larger body of infantry than the brigade; and with regard to the latter they are limited to its formation in reserve and to its deployment into lines of battalions at full intervals, which formation immediately precedes that for attack.¹

Arms used by Russian Infantry.

Rifle.—The Berdan (pattern 1871), a “door-bolt” breech-loading arm, is now issued to the whole of the infantry and rifle battalions of the standing Army. The local and depôt troops still retain the Krinka or the Carlé rifle, with one or other of which inferior weapons the greater part of the Russian infantry was armed during the last Turkish war.

The Berdan has a calibre of 0·420 in. and six grooves. Its weight is 9 lbs. 4 oz. without the bayonet, and 10 lbs. 3 oz. with it. Length, without bayonet, 4' 5", and with it 6'. The bayonet is always fixed on service, the scabbard being left at home. The bullet is of lead, hardened with tin, and weighs 371 grains. Charge of powder 79 grains. Cartridge, central fire, of solid brass and bottle-necked, weighing in all 608 grains. Initial velocity, 1,356 feet per second, with a very flat trajectory at short ranges. Sighted up to 1,250 yards, will carry up to 2,200 yards, and can fire from 12 to 15 shots per minute.

Tessak.—A short, straight two-edged sword, worn now only in time of peace by non-commissioned officers when off duty.

Sword.—Sergeant-majors wear swords like Officers.

Revolver.—Sergeant-majors, drummers and buglers carry the Smith and Wessen revolver in a leather case on the waistbelt, secured by a cord passing round the neck. This revolver has six chambers, and weighs 2 lbs. 6¼ oz. Calibre, 0·401 in. Charge of powder, 34 grains. Bullet weighs 200 grains. Cartridge, central fire and of solid brass.

¹ A British Officer, who is a competent judge, and who has had plenty of opportunities of studying the Russian Army of late, remarks that “the infantry drill is second to none; and the same may be said as to the instruction given to young Officers. In the winter, they are kept hard at theory in barracks from morning to night, and it is quite a relief to them when the climate allows them to get out of doors.”

Musketry Instruction.

Before the late Turkish war the only troops who received careful instruction in rifle-shooting were the riflemen, who were armed with a superior weapon, and received 150 rounds annually for target practice. When, however, the Berdan rifle was generally introduced, light companies abolished, and all infantry placed virtually on the same footing, the old regulations for musketry instruction, dating from 1876, were replaced by a new code drawn up by a committee presided over by the Inspector-General of Musketry, which code came into force in 1879. Every infantry soldier was required to fire 150 rounds yearly. It soon, however, became apparent that the course of training required too much time to be carried out properly under the present system of short service, particularly as rifle ranges are so often deficient, both at the garrison towns and at the camps of exercise. It became, therefore, necessary to curtail the course, and a new code of instruction was issued on the 28th March, 1881, which, without departing from the general principles adopted in 1879, considerably reduced the demands upon the soldier's time. The annual course is divided into "preparatory practice," the "regular course," and "field firing:" 130 rounds in all are fired. Preparatory practice is carried on at 200 and 300 paces. Recruits also fire 8 rounds at 100 paces. Three shots in four must hit the target at each practice, before the firer is allowed to go on to the next one. The "regular course" consists of fourteen individual practices, executed in various positions and at various targets, on the different ranges between 200 and 800 paces, four rounds in each practice. After this comes rapid independent firing at 200 paces; then volley-firing, lying down, kneeling and standing at targets between 300 and 900 paces. Great importance is attached to the last-named practice, which is succeeded by "field firing," to which 32 rounds are devoted. The men are divided into three classes at the end of the "regular course," according to the marks obtained therein. "Field firing" is, as a rule, performed by companies independently, under their Captains. It is divided into two practices—individually, and from eight to twelve collectively, at unknown distances, including "indirect firing" at concealed targets.

When a body of troops is firing at long unknown ranges the rear rank men sight their rifles 100 paces under the estimated distance.

Officers have to go through the same course of target practice as the men. During the winter months much attention is paid to position and aiming drill, a chamber rifle being also used in barracks as a preparation for the regular target practice.

Although a great stimulus has been given to rifle-shooting, the results have by no means been universally satisfactory. In the course of 1881 the Inspector-General of Musketry and eight other specially selected Generals visited 340 different corps of infantry, cavalry, and engineers to ascertain how far the instructions as to preliminary drill and target practice were carried out. Their report was not, on the whole, favourable. This may be accounted for partly by the want of a sufficient number of good instructors, but principally by want of time and by the scarcity of ranges. Out of the 340 corps visited, only 124 had completed the annual course; 314 were inspected, and although the rifle battalions were alone pronounced to have made *excellent* practice, whilst the guards and grenadiers only did as a rule *fairly well*, and the performance of the line infantry was *indifferent*, yet it must be remarked that the figure of merit of even the last-named troops was 8 per cent. higher than the year before, so that there is evidently a marked improvement. The Officers' practice with rifle and revolver was on a par with that of the men of their several corps.

At field-firing the Officers led their men with intelligence and coolness, as

did also the sergeants. The corporals did less well, and the performance of the men was far from satisfactory.

The scarcity of good instructors, want of time and of ranges, have already been mentioned as impediments to good rifle practice in the Russian Army; but there is another circumstance which perhaps still more stands in the way of progress in this direction, and that is the prejudice which still exists in the Russian Army, and in high and influential quarters too (a prejudice, by the way, not altogether confined to Russia), in favour of the old bayonet tactics, combined with steady shoulder to shoulder movements, in opposition to the "new-fangled" theories about fighting in extended order and the development of rifle fire.

The Dress and Equipment of the Infantry.

Changes in dress and equipment have long been contemplated, and particularly since the last Russo-Turkish war. The present regulations upon these matters date from January and November, 1881. Considerable changes have been made, the principal of which are noted below, whilst giving a general description of dress and equipment. A double-breasted coat fastened by hook and eye, the only buttons being on the shoulder-strap, has been substituted for the old single-breasted tunic fastened by buttons. The new coat is made all in one piece, very roomy in the body and skirts, and can be drawn together so as to fit the waist by means of an inner belt. The advantages of the new costume are considerable. First of all, the absence of buttons, which are troublesome to clean, and which make the wearer unpleasantly conspicuous; secondly, the roominess of the coat, which leaves free play to the lungs and arms, and admits of extra clothing being worn underneath in cold weather; thirdly, the ease with which a coat may be made to fit almost any man merely by shifting the hooks and eyes—a great point when the reserves are called out on mobilization. As the principal of these reasons for the change does not apply to Officers, they are allowed to gratify their taste for smartness by having their coats made to draw in at the waist, but, like the men, they are deprived of their buttons. They retain their epaulets. The men have side-pockets for ammunition in their tunics. The different-coloured badges which serve to distinguish the regiments of each infantry division are sewn on the collar. Brigades are known by the colour of the shoulder-strap. Coat and trousers are of dark-green cloth; but, in summer, blouses and trousers of white linen are generally worn. Trousers are made short, and to tuck into the boots (which reach to the knee), and are always worn so on duty. A comfortable black busby, without a peak, has been substituted for the old shako. A forage cap is also carried. The waistbelt is of black leather, and the two ammunition-pouches, each containing twenty rounds, are suspended from it.

The men have double-breasted grey cloaks, with hoods; also cloth mits, neckcloths (the fashion of which has been altered by the new regulations), and cholera belts. Bandages are worn on the feet instead of socks—in summer of linen, in winter of wool.

Officers of all ranks wear short trousers, tucked into the boots, on duty, but long braided trousers when off duty.

The knapsack, which was large and heavy, has been given up, being replaced by a waterproof bag made to hang over the right shoulder, secured by a fastening round the hips, and connected with a portion of a tente d'abri, which each soldier is in future to carry. The cloak is worn "en bandoulière" over the left shoulder, with a waterproof havresack containing three days' rations. A tin bag, containing forty-four rounds of ammunition, is secured in the kit-bag. These rounds will be transferred to the coat-pockets in action. The Russian soldier carried formerly a very large service kit, weighing, with arms, ammunition, and three days' rations, over 80 pounds. Although extra

ammunition and a portion of a tente d'abri have been added to his load, the authorities aim at reducing the total to 60 pounds—a result which can only be attained by a considerable reduction in the amount of “necessaries” carried in his bag. This subject is still under consideration, and we believe that as yet no definite arrangement has been made.

Each soldier, further, carries a wooden water-bottle; and 80 short spades, with 20 axes, are distributed amongst the men of each company; in addition to which tools, 10 spades, 24 axes, 3 shovels, 3 picks, and 1 crowbar per company are conveyed in the ammunition-wagons.

Of all the infantry, the Guards alone retain the old tunic—that is to say, double-breasted, and turned back in front, with two rows of buttons stamped with the imperial eagle, yellow in the 1st and 2nd divisions, and white in the 3rd. The shoulder-straps are red, bearing an imperial crown, with other honorary marks. The new short trousers have been adopted, but with narrow red stripe. The old black helmet, with metal ornaments of the same colour as the buttons, is retained; but the new forage cap has been introduced, also the cape. In other respects the dress and equipment are the same as in the Line Infantry; and the coat now worn by the latter is so much approved of, that it is thought probable that the Guards will ere long adopt it.¹

The Cavalry.

Regiments of the Guard are distinguished by titles and honorary designations; regiments of the Line by numbers, local titles, and, in most cases, by the names of honorary colonels.

There are to be in future six squadrons in each cavalry regiment in peacetime, with the addition of one dépôt squadron in time of war. The establishment of the service squadron will be about the same in peace as in war, namely, 145 horses. The regiment will, therefore, muster 870 combatants. The augmentation is being made gradually, and is to be completed in three years.

The regular cavalry regiment, whether of the Guard or Line, has consisted hitherto of four field squadrons and one dépôt squadron, with one company of non-combatants. The latter is employed in peace time to break the remount horses before they join the regiment in war time, to train both man and horse, so as to keep the field squadrons up to their strength. It has two establishments—one permanent as a cadre, the other variable according to the number of young soldiers and horses required by the regiment. The dépôt squadrons of line regiments are quite independent of these, as regards administration and command, being grouped by sixes in dépôt brigades, each of which feeds two Divisions, with the exception of the four dépôt squadrons of the Caucasus, which form the dépôt brigade of the Cavalry of the Caucasus. The dépôt squadrons of the Guard, on the other hand, are not separated from their regiments in peace time, but in time of war form a dépôt brigade of the strength of ten squadrons. On mobilization and during war, Officers and men of the reserve who have previously served in the Cavalry join the dépôt squadrons, to be formed into provisional detachments and sent to the front as required.

The Field Regiment is composed of four squadrons, each consisting of four sections of 16 files combatants.

¹ The change has, we are informed, already been made (1883). The new uniform has not only its own intrinsic merits, but sentiment in its favour, being much of the same pattern as the dress worn by the Russian peasant.

OLD ESTABLISHMENT OF A CAVALRY REGIMENT (THE NEW ESTABLISHMENT IS NOT YET PUBLISHED).

Combatants.

Officers.						Peace.	War.
Commanding Officer ¹	....	....	....	....	....	1	1
Commander of Wings	{	Colonel	....	....	....	1	1
(two Squadrons)		Lieutenant-Colonel	....	....	....	1	1
Commanders of Squadrons—Captains	....	....	....	....	....	4	4
Staff: 1. Regimental Adjutant; 2. Treasurer and Quartermaster; 3. Instructor in Arms; 4. Commander of the Non-combatant Company and in charge of the regimental Hospitals	....	....	....	....	....	4	4
Subalterns	....	....	....	....	....	20	20
Total Officers						31	31

Non-commissioned Officers and Privates.

Sergeant-Majors	....	....	....	....	....	4	4
„ of the Non-combatant Company	....	....	....	....	....	1	1
Quartermaster Sergeants	....	....	....	....	....	6	6
Non-commissioned Officers—1st Class, Sergeants	....	....	....	....	....	16	16
„ „ 2nd Class, Corporals	....	....	....	....	....	28	29
Regimental Trumpeter	....	....	....	....	....	1	1
Trumpeters....	....	....	....	....	....	16	16
Acting Trumpeters	....	....	....	....	....	4	4
Lance-Corporals	....	....	....	....	....	16	16
Privates	....	....	....	....	....	604	604
Volunteers	....	....	....	....	....	16	16
Total Non-commissioned Officers and Privates						712	713
Total Officers						31	31
Total Combatants						743	744
Total Non-combatants						87	91
Grand total						830	835

Non-Combatants.

Classed as Officers.						Peace.	War.
Surgeons, 1st Class	....	....	....	....	....	1	1
„ 2nd Class	....	....	....	....	....	1	1
Veterinary Surgeon	....	....	....	....	....	1	1
Accountant....	....	....	....	....	....	1	1
Riding Master ²	....	....	....	....	....	1	0
Chaplain	....	....	....	....	....	1	1
Total classed as Officers						6	5

¹ In the Cavalry of the Guard, the regimental commissioned Officer is a Major-General; and both commanders of divisions, Colonels. One of the latter Officers manage the regimental funds and workshops.

² Goes to the Dépôt Squadron in war time.

Other Ranks.

Classed as Officers.						Peace.	War.
Clerks, Regimental	....	....	....	....	....	1	1
„ 1st Class	....	....	....	....	....	4	4
„ 2nd Class	....	....	....	....	....	5	5
Hospital Attendants	{	1st Class	....	....	....	1	1
		2nd Class	....	....	....	2	2
		Squadron	....	....	....	4	4
		Apothecary	....	....	....	1	1
		V. S., 1st Class	....	....	....	1	1
		„ 2nd Class	....	....	....	4	4
Dressers	....	....	....	....	....	5	0
Superintendent of the Sick	....	....	....	....	....	1	1
Hospital Orderlies ¹	....	....	....	....	....	2	2
Sacristan	....	....	....	....	....	1	1
Armourer Sergeant	....	....	....	....	....	1	1
Armourer, 1st Class	....	....	....	....	....	1	1
„ 2nd Class	....	....	....	....	....	1	1
Master Farrier	....	....	....	....	....	1	1
Master Saddler	....	....	....	....	....	1	1
Tradesmen	....	....	....	....	....	16	16
Cutter	....	....	....	....	....	1	1
Fitter	....	....	....	....	....	1	1
Tailors and Shoemakers	....	....	....	....	....	20	20
Drivers ²	....	....	....	....	....	6	16
Total other ranks						81	86
Classed as Officers						6	5
Total Non-combatants						87	91

Horses.

Chargers	{ Officers ³	....	....	....	....	33	74
	{ Men	....	....	....	....	577	577
Draught	....	....	....	....	....	15	51
Ridden by Non-combatants	....	....	....	....	....	0	4
Total Horses						625	706

The regular Cavalry is organized in two Divisions of the Guard and eighteen Divisions of the Line, the latter consisting each of four regiments, including one of Cossacks to each Division quartered in Europe (fourteen in number). The 1st Division of the Cavalry of the Guard comprises, like all the Line Divisions, two brigades; but the 2nd Division consists of three brigades, in the second of which is the squadron of the Oural Cossacks of the Guard, in addition to a regiment of Cossacks. There are three Divisions of Cavalry of the Caucasus, each formed in two brigades. In the 1st Division are three regiments of Cossacks; in the 2nd, four; and in the 3rd, three. The 18th Line Division is that of the Don Cossacks, composed of four Cossack regiments, formed in two brigades. The Cavalry Divisions of the Guard have five batteries of Horse Artillery and a Don Cossack battery, which form an independent brigade in peace time (with the exception of one battery

¹ There are eight when the regimental Hospital is open.

² All Cavalry, except Dragoons, have 15 per regiment. Those of the Caucasus have 27 in war, 18 in peace.

³ Of these 9 in peace and 50 in war are the Officers' private property.

detached to Warsaw), but in war time are distributed amongst the three Divisions. Line Divisions 1 to 7, and also 13, 14, have each two batteries of Horse Artillery. Divisions 8 to 12 have each one battery of Horse Artillery and one Cossack battery, whilst Divisions 15 to 18 have each two Cossack batteries.

The Guard Divisions form part of the Guard Corps. The Don Cossack Division is attached to the Grenadier Corps. Line Divisions 1 to 14 belong to the Army Corps with similar numbers. The 15th and 16th Divisions (1st and 2nd of the Army of the Caucasus) are attached to the 1st and 2nd Army Corps of the Caucasus. The 15th Army Corps has no cavalry; whilst the 17th Cavalry Division (3rd of the Caucasus) is at present unattached. The Bashkir regiment, originally formed in 1874 and brought up to full strength in 1878, consisted of 35 Officers and 270 men, detached from the regular Army for the purpose of training the Bashkirs who served for short periods, and whose complete establishment was 604. This regiment was disbanded in July, 1882, and is to be replaced by a Militia corps. The drafts from the regular cavalry returned to their regiments, and the Bashkir soldiers were enrolled in the reserve.

The Commanders of Divisions are Lieutenant-Generals. They have the usual staff—a Colonel as Chief, two Adjutants, Surgeons, &c. As in the Infantry, this brigade command counts for little except in the field. The senior regimental Commanding Officer usually commands the brigade without the help of any regular staff.

Whilst, as we have seen, the ordinary Cavalry regiment is broken into two wings, each consisting of two squadrons, the Cossack regiment (Polk) is formed in three divisions, each likewise of two squadrons (sotnias) of about the same strength as the Line squadrons; the Cossack regiment is thus half as strong again as an ordinary Cavalry regiment.¹ But there are many peculiarities in the organization and habits of Cossack troops which will be noticed further on.

Always excepting the Cossacks, who are horsemen from their childhood, and to a less extent the inhabitants of the western and southern provinces, in which the Cavalry Divisions are mostly stationed, and where the supply of horses is comparatively large, the Russian peasant has not much opportunity of learning to ride; hence the material for Cavalry, in point of men, is not particularly good. However, the recruits apparently best fitted for this purpose are selected from the annual contingent, and the enormous supply of ready-made horsemen in the Cossack regions goes far to make up for a deficiency in this respect in other parts of the empire.

Cavalry Officers in Russia, as in some other countries, in great measure belong to the richer classes.

ARMS AND EQUIPMENT.

Cuirassiers (now only of the Guard).

Tunic.—For full dress, white cloth, with piping and shoulder-straps of distinctive colours; for undress and active service, dark green cloth, with similar ornaments.

Cuirass of yellow metal, weighing 17 to 20 lbs.

Overalls.—Full dress, dark blue, with dull red stripe; undress on active service, French grey pantaloons, and knee boots.

Headdress.—Helmet of yellow metal, with a double eagle on the top for state occasions; also a flat white cloth cap, without a peak, which is worn on service.

¹ The strength and organization of ordinary and Cossack cavalry regiments will apparently be the same in future.

In summer and on fatigue, white linen tunics and trousers are worn, as in the Infantry.

Cloak, the same as in the Infantry.

Leather gauntlets. Straight steel spurs.

Waistbelt, white leather, with revolver-case on the right side. Sword (of a new pattern, straighter and lighter than of old), in a wooden scabbard, covered with leather, and suspended by a white crossbelt over the right shoulder, instead of, as formerly, in a steel scabbard secured by slings to the waistbelt. A small pouch for revolver-ammunition is on the crossbelt.

Front-rank men are armed with the lance, as well as with sword and revolver. The lance is nine feet long, and weighs 6 lbs. 11 oz.¹

The revolver is the same as that used by the Infantry and other arms, already described.

Horse appointments.—There is only one pattern of saddle for all the regular Cavalry. The tree is of wood, and consists of pommel, cantle, and two side-bars, without stuffing, to which the leather flaps are fastened. The horse's back is protected by a piece of felt, covered by a leather numnah, called "potnik." The seat of the saddle is formed by the horse-rug, called "woylach," folded four times, and secured by a surcingle. The horse-rug is used to cover the horse when bivouacking, and the double service to which it is put creates a difficulty in case of a sudden alarm. It is, therefore, intended to give the regular Cavalry a leather saddle-seat.² In front of the saddle are fastened two wallets and the cloak; behind it the forage bag, filled with oats, and a valise to which is attached the mess-tin. A picket-rope is carried in front of the rider; also a hatchet on the off-side of the saddle, and behind him hangs the hay-net across the horse's flanks. The chabraque, which weighed over 6 lbs., and covered the whole load, has now wisely been done away with. The horse, as it is, has to carry an equipment which, including two days' forage, weighs over 150 lbs.; so that, putting the rider with arms and accoutrements at 210 lbs., the full load on the horse amounts to 360 lbs. (nearly 26 stone). It is not surprising, therefore, that during the last Turkish war a great many horses broke down very soon, or that the military authorities, here as in other countries, should be turning their attention to the question of how the trooper's load can be lightened. Each squadron of cavalry carries with it eight hatchets, eight pickaxes, and sixteen scythes. A horse's daily ration consists of 4 garnez³ of oats for the Guards (3 garnez for the Line and Cossacks), with 10 lbs. hay and 4 lbs. straw. When hard worked, the horses have a larger allowance. In summer, or sometimes autumn, according to an old custom which bids fair to fall into disuse, green food alone is given, part of the time in the stables, and part out at grass.

Lancers (now only of the Guard).

Tunic, dark blue, with scales and lappets.

Overalls.—Full dress, black, with red stripe; field-service, French grey pantaloons, with boots.

Headdress, a black cap, with coloured ornaments distinguishing the regiment.

The other articles of clothing are the same as those of the Cuirassiers, except that the men wear woollen gloves.

¹ There is a party in the Russian Army in favour of doing away with the lance entirely.

² This has, we are informed, already been done; a new pattern of saddle having been adopted, the leather numnah of which has pockets. Cloak, &c., are carried as before. The girth has three bearings, to prevent rocking.

³ The garnez is a measure, eighty of which go to the sack of oats, the weight of which ranges between 4 and 5 "pouds" (160—200 lbs.) The garnez thus weighs from 2 to 2½ lbs.

Equipments.—White leather waistbelt, carrying a revolver-case and two pouches supported by a strap over the left shoulder. The pouches contain 40 rounds of carbine ammunition.

A narrow white leather swordbelt, with short slings, is worn over the right shoulder.

Arms.—Front-rank men are armed with lance, sword, and revolver; rear-rank men, with carbine and sword. The lance is the same as that for Cuirassiers, but with black shaft, and is carried in a bucket on the right stirrup. The sword is curved, three feet four inches long, and weighing 2 lbs. 12 oz. The scabbard is of wood, covered with leather. The revolver is that in general use.

The carbine is the Berdan (pattern 1871), and in every respect like the Infantry rifle, except that its length is only four feet and its weight 7 lbs. 6 oz. Horse furniture as for Cuirassiers.

Hussars (now only of the Guard).

Dress.—Tunic, scarlet, with yellow braid. Pelisse edged with black fur. Pantaloons, dark blue and braided. Busby with black horsehair plume and scarlet bag. A cloth cap worn in undress. The other articles of clothing are the same as for the Cuirassiers, only that the men wear woollen gloves.

Equipment.—White leather waistbelt, with sword-slings and sabretasche; white leather crossbelt.

Arms, the same as for Lancers.

Horse-appointments as for Cuirassiers.

Dragoons.

Dress.—Tunic, almost the same as that worn by the Infantry, except in the regiments of the Guard, which have a double-breasted one. Regiments are distinguished by their collars, facings, and collar buttons.

Overalls.—The Guard regiments wear for full dress dark-green overalls, with a double red stripe. For field service they wear, like the rest of the dragoons, French grey pantaloons and boots like all other cavalry. The Grenadiers of the Guard (mounted) wear a leather helmet, with a fringe of bearskin over the top from ear to ear.

The Guard Dragoons have leather helmets, and all other dragoons black Astracan caps, with the arms of Russia in front. In undress or on service the flat cap is worn. Other articles of clothing as for Hussars.

Equipment as for Lancers. The carbine is carried in a leather case slung over the left shoulder, so that the butt rests behind the right thigh.

Arms.—Dragoons carry carbines, bayonets, and swords; non-commissioned officers and trumpeters, swords and revolvers. Carbines the same as for Lancers.¹ Sword and scabbard, ditto.

Bayonet can be attached to the carbine for fighting on foot, and at other times is carried in a sheath which is fastened to the sword-scabbard.

Revolver as usual. So also horse furniture.

The Art of Riding in the Russian Cavalry.

Since the introduction of short service, expertness in the exercises of the riding-school has diminished; but, on the other hand, the regular Cavalry can ride across country much better than they did formerly. This is partly

¹ In 1880 a Commission recommended that all Russian Cavalry, except Cuirassiers, should be armed with the Infantry rifle—a measure which is being carried out, at any rate with regard to Dragoons, who have already been seen to march past the Emperor on foot carrying the long rifle with bayonet fixed. It is slung on the back of the mounted dragoon in a leather case.

owing to the fact that the proportion of horses from the Steppes is constantly increasing in the service—a class of horse whose build and action are not very suitable for parade purposes, but which is eminently fit for the field, being active, enduring, clever, and sure-footed. Again, the practice introduced of late years of brigading Cossack regiments with the regulars, has produced an excellent effect upon the field-riding of the latter; whilst the former have, owing to this connection, improved in steadiness and regularity of movement. A strong feeling has of late shown itself in the Russian Army in favour of the Cossacks as the *beau idéal* of cavalry, and of substituting the snaffle, at present peculiar to the Cossacks, for the bit now used by the regulars. Riding-schools are rather scarce, and therefore mounted drill becomes often a great hardship for the recruit in winter, as it must be carried on in the open air, and frequently during hard frost. Recruits always ride with reins until just before they take their place in the squadron, when they go through a few rides without them. Recruits' drill goes on till the 1st May, when riding commences with spurs and in close order. Immediately after the recruit begins to ride with spurs, he begins to practise the sword-exercise on horse-back. Great attention is paid to this, as also to vaulting on the wooden and real horse. The young soldier is taught to vault upon his horse whilst the latter is at the walk, trot, or gallop; this branch of training being concluded by practice in mounting on, and dismounting from, a horse in movement and fully caparisoned.

The paces for Russian Cavalry are, at the walk, 125 paces in the minute, equal to about $3\frac{1}{4}$ miles an hour; at the trot, 300 paces in the minute, equal to about $7\frac{1}{2}$ miles an hour; at the gallop, 400 paces in the minute, equal to $10\frac{1}{3}$ miles an hour; at the charge, 800 paces for the first minute. Much attention has been paid of late, here as in Germany, to keeping up a fast pace for a considerable time, and, during the summer drills; practice of this description is conducted on courses prepared for the purpose, the time taken in going over a certain distance being carefully noted. These drills last from one to two hours, the horses being kept at the walk, trot, and gallop in turn.

Then comes drill in marching order, and chiefly at a rapid pace, the duration of which is gradually lengthened to three or four hours.

Marches are also made, with full field-equipment, for long distances up to 23 miles out and back, outpost and reconnoitring duties being practised on the way; and, according to the new regulations which came in force in the spring of 1882, exercises of this description are to be carried on for several days in succession towards the end of winter. One great obstacle to improvement in cross-country riding has hitherto been the small partiality for it shown by Officers, who, not being found in chargers by the State, but only receiving one horse ration, with the right to remount themselves every fifth year from the Government establishments at the regulated price, kept but one horse, and seldom rode except on duty.¹ Grand Duke Nicholas the elder did a good deal towards remedying this defect, by insisting upon it that all Officers of means should provide their own horses, and use them for riding instead of for driving, as was their custom formerly. Encouragement was also given to sport, and all Cavalry regiments, as well as Horse Artillery batteries, are now compelled to have annual steeplechases (distance nearly $1\frac{1}{4}$ mile), in which Staff as well as Regimental Officers must take part. The Cavalry Officers of the Guard, who still have no chargers found for them, keep a good many race-horses. There are great military races at St. Petersburg every year. But notwithstanding all these inducements, Russian Cavalry do not, as yet, excel, in cross-country riding.

¹ Since September, 1881, Line Cavalry Officers, except those commanding regiments, are supplied with horses by the State.

Regulations for Drill and Instruction.

Those now in force date from 1881, and are complete, except the part concerning fighting on foot, which is still in course of preparation.

A careful distribution of time for the exercises of the whole year has been made, and is now generally carried out. The arrangements under this head will be noticed when treating of the system of instruction for the army in general.

The great object aimed at by those who compiled the present Cavalry Field Exercise Book was to attain greater handiness, pliability, and rapidity of movement, so as to be able to show front as quickly as possible in all directions. In order to attain this, the bugbear of inversion was dispelled, and the German system of squadron columns and deployment was introduced.

All means were taken to encourage individual initiative amongst Officers, and they were authorized to depart from regulation upon their own responsibility.

The Squadron consists of four equal sections, which are drawn up with non-commissioned officers upon each flank of the front-rank men, who stand bridle to bridle, and are told off by files and by threes throughout each section, as in Germany, instead of throughout the whole squadron, including commissioned Officers, as was the case formerly. All squadron Officers are in front, and should there be two to a section, each posts himself one pace in front of the second file from a flank. Should there be only one Officer to a section, his post is in front of the centre, in case of one of the centre sections, but in front of the second file from the outer flank in case of the first or fourth sections. There are no serrefiles, even when, as it sometimes happens, there are seven or eight Officers besides the squadron leader. One pace behind the rear rank is the line of non-commissioned officers, serrefiles, with the sergeant-major in the centre. The squadron leader is at division distance in front of the centre.

Columns may be formed of divisions, of threes, of sections of threes, of files, and single file. The column of sections always marches by the right. When sections wheel by trumpet signal, it is done at the trot.

Attacks are made both in close and in extended order ("*en fourrageur*"). When attacking infantry or cavalry on open ground, the rule is to break into a trot at 2,000 paces from the enemy, into a gallop at from 700 to 800 paces, and into the charge at 300 paces. The rear-rank men keep at two paces distance from the front rank. Charges in extended order may be commenced at once from the halt, as well as by a body in movement, the pace being gradually accelerated as above described. The former method is applicable to the pursuit of a retiring enemy; the second to attacks upon very distant bodies of cavalry or artillery. As a general rule, men extend at the gallop, taking up the trot when their extension is completed. Should, however, it be intended to extend at charging pace, and the same pace to be kept up afterwards, the "charge" will be sounded. As a rule, only half the squadron is extended, the other half remaining in support; but sometimes the whole squadron is extended. After an attack, the skirmishers always close to the centre, the support moving up towards them. Should the skirmishers be recalled by order after closing, they move by sections to the flank of the support on which they have to form. Should, however, the "assembly" sound, the skirmishers rally at full gallop, and independently on the formed body, or if there be none, on the squadron leader. Charges are always directed on some visible object, first at a known, afterwards at an unknown distance. They are first practised against an imaginary enemy, afterwards by one body of cavalry against another, in which case the movement is timed, and the opposing bodies ride through one another's ranks. This is done at first only by Officers

and non-commissioned officers, afterwards by sections, and so on. The opposing parties are posted first at 2,000 paces from one another.

Four particularly well mounted men are selected from each section to act as scouts ; i.e., 16 for the squadron. An Officer is selected to command them, and has a non-commissioned officer and a trumpeter attached to him. When the scouts of one or more sections are called out, they assemble in front of the squadron to receive their instructions, and then ride off to their destination, generally in groups of four ; they carry their swords drawn. Besides these scouts, each squadron has six picked troopers or non-commissioned officers, called "dosory," or watchmen. When the squadron is advancing, two of these men ride in front ; when it is retiring, the other two keep behind, the remaining two being told off, one to precede the squadron, if taking ground to the right, the other to perform the same office in case of a movement to the left. They keep at about 300 paces from the squadron, and communicate by signal with the chief.

Small piquets are further employed for the purpose of observation, each consisting of two or three or more troopers under an Officer or non-commissioned officer. It will be seen, therefore, that outpost and reconnaissance duties are well provided for in the squadron.

The *Regiment* when in line has its four squadrons at section interval. They may be either in the proper order of their numbers, commencing from the right, or they may be drawn up without regard to this order. Squadrons 1 and 2 constitute the right wing, Squadrons 3 and 4 the left wing, each under a commander whose post is in front of his wing. When the squadrons are not standing in the order of their numbers, the wing Commanders must be told which squadrons they are to command. There is a fixed post for each Officer, but field Officers and squadron leaders may quit these posts when their duty can be performed better elsewhere ; but sub-alterns leading sections remain under all circumstances, even in close column, in front of their respective sections. The senior Officer after the squadron leaders, is in rear of the regiment, in rank with the serrefiles. If there are two standards with the regiment, one remains in the centre of each wing ; if there be only one, it is placed between the wings.

Columns of *route* are formed in the same manner as by single squadrons, each of the latter keeping section distance from the one before it.

Regimental column of Sections.—Each squadron breaks into column of sections, following that before it at half-squadron distance.

Regimental column of Squadrons.—Either an open column, when each squadron keeps five sections distance from the one before it, or a close column with one section plus five paces distance.

Section leaders in front of their sections ; squadron leaders and field Officers on the directing flank.

Reserve columns.—The squadrons, each formed in column of sections, are drawn up in line at seven paces interval.

Line of Squadron columns, with full intervals. This is the normal preparatory fighting formation. Squadrons are in columns of sections.

Line of Squadron columns by wings is also used, which is virtually a *double-regimental column of Sections*, with full deploying intervals between wings.

Wing and squadron Commanders repeat the regimental Commander's cautions ; but section leaders do so only if their sections are specially named, or if the voice of the squadron leader is not clearly heard. The executive order was formerly only accompanied by a wave of the sword, but of late the practice of replacing this by a trumpet signal in particular cases has been introduced. Deployment and changes of front on the move are always executed at an accelerated pace. A movement in retreat is on no account to be carried out at a quicker pace than the trot.

Line is formed from regimental column always on the leading fraction, and to the left of it unless otherwise ordered. When an open regimental column of squadrons, or a line of squadron columns of sections at full intervals, is required to form line to the front, each section moves obliquely to its proper post, instead of making two wheels of quarter-circle, as was the former practice.

When line is formed from *reserve column*, the two centre squadrons form to the front on their inner sections, whilst the other squadrons wheel outwards by sections, and, when they have got their proper distances, wheel up again and form line on the centre squadrons.

At the special request of the Emperor, the old movement of retiring by échelon of wings, each of which shows front alternately to cover the retreat of the other, has been retained.

Échelon movements, both to front and rear, and also to a flank, are much practised, both from line and from squadron column. The "half-column" formation of the Germans, *i.e.*, the movement in oblique échelon of squadrons, after wheeling up the eighth of a circle, is much used. Line may be formed on the leading body of an échelon, either by those in rear accelerating their pace while that in front moves on steadily, or by making the latter move at a walk or even halt. A regiment must never charge in one line, unless its flanks be covered by other troops; if this is not the case, a portion of the regiment must always be held back in reserve. When acting against cavalry, the rule is to show as wide a front as possible, and to aim at turning the enemy's flanks. In all other cases, especially when charging formed infantry, the attack should be made by successive lines not less than two in number. The scouts and flankers of each squadron are under a non-commissioned officer, an Officer commanding those of the wing (two squadrons).

Part III of the new Field Exercise Book, which treats of the formation and evolutions of large bodies of cavalry combined with horse artillery, is still under preparation. The general principles which appear to have been adopted are those which now prevail in the German cavalry, and which are so well known to tactical students.

Russian organization is, however, not favourable to the full development of the German system, as the Cavalry Division consists only of four regiments instead of six as in Germany; consequently the formation of three lines for attack, adopted in the latter country, cannot so conveniently be carried out in Russia. For the present, therefore, the rule is to form two lines, from the first of which (the fighting line) detachments are kept back on each flank at a distance of some 200 or 300 paces in support, whilst the troops in the second line are massed about 400 paces in rear of the supports of the first line as reserve. The division, when formed for action, is always preceded by a chain of skirmishers. Its front is from 500 to 1,000 paces, according to whether one or two regiments are in first line; its depth from 700 to 900 paces, with the normal formation just described—1,500 paces if formed in three lines (one regiment in first line, two in second, one in third). The distribution of regiments in two or more lines is left to Generals of Divisions and of Brigade, if the latter be acting independently, although, as before remarked, the formation in two lines is considered the best by those in authority under present circumstances. It does not seem, however, improbable that the present organization of the Division in four regiments will ere long be discarded, and that the German organization of six regiments to the Division will be adopted—a change which will doubtless be followed by a corresponding tactical alteration.

When in reserve the four regiments of the Division are formed sometimes in regimental columns of squadrons, but more frequently in *reserve columns*, in two lines by brigades, with the artillery 60 paces in rear of all. The front is thus 300 paces, and the depth 375.

Fighting on foot is in great favour with Russian cavalry, including the

Cossacks, particularly since the introduction of the Berdan musket and carbine. The new Book of Musketry Instruction establishes conditions for the target practice of cavalry approximating to those in force for infantry, and in like manner the rules laid down in the Cavalry Field Exercise Book for fighting on foot in extended order are pretty nearly the same as the last new regulations on the same subject for infantry. The difference which formerly existed between the foot drill of Dragoons and Cossacks from that of Lancers and Hussars has almost disappeared; and, were it not so, the matter would be of little consequence now that all the Line Cavalry is converted into Dragoons.

Numbers 1 and 3 of threes dismount, No. 2 remaining mounted as horse-keeper; thus two-thirds of the men are available for skirmishing. Men of a section are kept together, amounting, with Dragoons, to ten or twelve file, with Cossacks to eight or nine file. Squadron leaders dismount and take command of the parties on foot. A detachment remains mounted, to protect the horse-keepers and horses, who are placed under cover as close at hand as possible. Dismounted cavalry are trained, like infantry, to throw up earthworks and charge with the bayonet; in fact, the aim is to make cavalry feel itself able to act independently under all circumstances, and it is hoped that without sacrificing the efficiency of cavalry in its primary employment, that of fighting on horseback, it may be possible at the same time to train it so thoroughly for dismounted action as to place at a Russian General's disposal a great mass of horsemen provided with entrenching tools and fit to measure themselves on foot with the enemy's infantry, whilst equal, when mounted, to any encounter with his cavalry. A force of this description, acting in front of the main army or on the flanks and rear of the enemy, will doubtless exercise a great effect in warfare. The question, as yet undecided, and about which opinions in all countries are much divided, is whether troops can be made to act with real and equal efficiency both on foot and on horseback. The Russians are preparing to try the experiment on a very large scale. The result will be watched with interest. Firing from the saddle is only allowed with the revolver, or exceptionally to give the alarm, and horsemen are taught that the sabre is their only arm for attack, which must always be conducted with the utmost energy.

Training for Field Duties.

In the remarks upon this branch of instruction, as imparted to the Army in general, we shall touch upon its application to Cavalry; but we may here notice some details in the new regulations for summer drills, specially relating to the mounted branch of the Service, and to its instruction in field duties, to which particular attention is devoted, and which is systematically conducted. This instruction commences in winter with the theoretical part, followed up in spring with the elementary and mechanical part of the practical course, on foot. Then come reconnoitring rides of Officers and non-commissioned officers; after which exercises with a tactical idea over varied ground, squadron against squadron, then Division against Division, starting at distances from one another resembling the probabilities of active service, say from one to two miles. These exercises last in the first instance for twelve hours, increasing in length to twenty-four hours at a stretch, being carried on both by day and night, giving the opportunity to practise field duties in all its branches, such as distant patrols, reconnaissances both of the ground and of the enemy, outposts, care of horses in the field, &c. Every endeavour is made to imitate the real thing as nearly as possible, and to keep the attention of all parties alive by changes of position at night, by sending scouts to penetrate by surprise into the position of the opponent, by laying ambushes and such like. Officers are required to make sketches of the ground, and reports upon the enemy. They must also, as well as the non-commissioned officers, be thoroughly acquainted with their own position. The latter are taught to read maps and to make

slight sketches. The director of the manœuvre, who is also the umpire, communicates to each party only what it might fairly be expected to know about its opponent in actual service; they must find out everything else for themselves. The manœuvre generally ends with a charge, after which comes the critique. In all these exercises of one body against another, representing the attack and defence of a convoy, the protection and destruction of a railway, the assault on a post, and in fact the many minor operations of war, much greater attention is wisely paid to the execution of the preparatory movements than to the actual conflict.

At the great manœuvres, for instance, at Krasnoe Selo and at Warsaw, Cavalry is used in the most thorough and extensive manner for reconnaissance and outpost work, forming bivouacks while thus employed.

Another opportunity of the same nature is afforded by the winter marches with troops of all arms enjoined by the new regulations, and carried out, as it would seem, by the troops of the Petersburg district in February, 1882.

The advantage to be gained by the last-named exercise is somewhat doubtful.

Much is done to improve the tactical and strategical instruction of Officers by the use of the war-game, by working out tactical problems on the ground, and by other such means; but as yet the same want is felt in the Cavalry as in other arms, of advanced professional knowledge amongst the superior Officers, owing to which the education of the younger Officers suffers.

In order to remedy this defect, a special course of instruction for field Officers has been provided at staff head-quarters and at military colleges, whilst the tactical educational standard for cadets has been raised.

Although the use and employment of *Divisional Cavalry* are discussed in Russian tactical manuals, and although, during their last war, cavalry was attached in larger or smaller numbers to the Infantry Divisions, the same course being also pursued at the great manœuvres, it has not as yet been customary to attach a cavalry regiment permanently to each Infantry Division, partly perhaps because there is a prejudice against doing so, lest the true cavalry spirit may be dulled by close connection with infantry, but principally because of the tendency to put off to the last moment the brigading of cavalry with the other arms, so as to have the opportunity of assigning to each commander a larger or smaller proportion, according to the requirements of the moment and to the leader's characteristics. Moreover, the present organization does not lend itself readily to the permanent allotment of cavalry regiments to Infantry Divisions, a Cavalry Division consisting, as we have seen, of only four regiments, being attached to each Army-corps comprising from two to three Divisions of infantry. This comparatively small body of horsemen allotted to the Army-corps is evidently unable to supply Divisional Cavalry without damaging its own fighting efficiency, as demonstrated during the last war. Two plans have been proposed for the purpose of overcoming this difficulty—either to increase the strength of Cavalry Divisions to six regiments, which is also desirable, as already noticed, for tactical reasons, or to employ the forty Don Cossack regiments of the second and third category (see page 237), which are to be embodied in war time as Divisional cavalry, keeping the present eighteen cavalry Divisions intact; but the latter combination is not a likely one, on account of the inevitable delay in mobilizing the Cossack regiments, which would only be ready to take the field four weeks after the order is issued.

The tactical employment of Divisional cavalry and of cavalry Divisions, respectively, is theoretically the same in Russia as in other European countries, particularly Germany.

The use of cavalry in large bodies for strategical purposes, that is to say, for independent enterprises against an enemy in process of concentration, or against his communications, or again for screening the advance of its own

main army, for temporary occupation of an invaded district, and for other similar purposes, appears to be fully appreciated in Russia, with the consciousness too of the large means available for such undertakings; for although the proportion of Cavalry to Infantry in the standing army is small in Russia compared to what it is in Germany, there being only twenty-one Divisions of regular cavalry, including that of the Caucasus and the first category of the Don Cossacks, against forty-eight Divisions of infantry, the former, too, weaker and the latter stronger than those of Germany, so that, allowing the usual number of two infantry Divisions to the Army-corps, there would be five Army-corps without any cavalry, whilst each of the others would have only from eighteen to twenty-four squadrons and sotnias, still, independently of the forty extra Don Cossack regiments to be raised on the outbreak of war, and to be formed into ten Divisions, which would join the twenty-four Russian Infantry Divisions then also to be organized, there would be still further supplies of horsemen from the Don territory, besides some thirty or forty regiments of Cossacks from Astrakhan, the Caucasus, the Ural, and Orenberg, all which levies would join the armies in second line, and be pushed to the front later on if required. Moreover, it is in contemplation to increase the strength of the regular Cavalry, for doing which there are abundant means.¹ All things considered, therefore, Russia may well feel confident of her ability to pour, as soon as war is declared, the nine or ten regular Cavalry Divisions kept at all times complete, together with their Horse Artillery, over the western and south-western frontiers, near which they are permanently stationed, and to support these afterwards with further masses of mounted men. The excellent firearm now issued or in course of issue to the Russian trooper, the thorough training in its use which he is receiving, combined with careful instruction in throwing up field-works, and, lastly, the Horse Artillery attached to Cavalry Divisions, should render them capable of independent action; and for such they are being carefully prepared in peace: witness the manœuvres in the Warsaw and Wilna districts. The constitution and distribution of cavalry Divisions or corps for great strategical movements are much discussed, and the question at present remains unsolved. The views of Russian tacticians upon the subject may be gathered from Drygalski's book on new Russian tactics, published at Berlin in 1880, to which we refer our readers for detailed information. They will see that there is in the Russian service a school of thinkers who discard the idea of employing regular cavalry in the manner hitherto habitual in European armies, as quite out of place in these days, and who advocate the use of mounted troops after the American fashion, to which they consider the Cossack nature admirably adapted.

(To be continued.)

INFANTRY FIRE v. ARTILLERY FIRE.

By Colonel LONSDALE HALE, Staff College.

THE physical effects of artillery fire and its intrinsic destructiveness as compared to the fire of infantry are questions of great interest which are frequently discussed at the present time. Although the limited experience of the Egyptian Campaign speaks well in some respects for the future of artillery, yet the opinion generally entertained of the power of this arm is assuredly not a high one.

¹ This, as we have before noticed, is already in course of execution.

It is not intended to discuss these questions fully in the following remarks, but, inasmuch as the well-known comparative statistics derived from the Franco-German War of 1870-71 are frequently quoted in works on Tactics and elsewhere in connection with this matter, and considerable weight appears to be attached to them, it is proposed to endeavour to ascertain what is their real value, and whether, when brought into court, as they so frequently are as witnesses against the gunners, they carry conviction solely because no one cares to cross-examine them and elicit all the facts of the case.

These comparative statistics are given as follows:—According to the late Colonel Home, in a note at p. 86 of “*A Précis of Modern Tactics*,” 94 per cent. of the Prussian loss in killed and wounded at the Battle of Gravelotte was due to infantry fire, 5 per cent. to artillery fire. Captain Thival, in a note at p. 291 of “*Rôle des Localités à la Guerre*,” quoting from the “*Revue Maritime et Coloniale*,” gives the Prussian losses of the whole campaign as 88 per cent. from infantry fire, 5 per cent. from artillery fire, and 5 per cent. from mitrailleuse fire. It is presumed that by the word “Prussian” “German” is intended by these writers. In the latest edition of “*The Soldier's Pocket Book*,” is accepted, at p. 375, 90 per cent. as hit at the Battle of Gravelotte by the Chassepôt bullet, and 6 per cent. by artillery projectiles, whilst at p. 112 the percentages of the whole campaign are given as 91 per cent. due to infantry fire and 9 per cent. to artillery fire.

It is, at the outset, desirable to remark that obviously these statistics can at the best be but approximately correct, and can be regarded only as comparative statements and not as actual facts.

The first step in the investigation is to ascertain what kinds of weapons were in the hands of the troops which inflicted the losses. The necessary information will be found in the third chapter of Captain Ellis's, R.A., translation of “*The War of 1870-71*, by M. A., a Prussian Artillery Officer.” The superiority of the French Chassepôt, with its small calibre, flat trajectory, and long range, over the Prussian needle-gun, not thoroughly effective at a greater range than 400 paces, is so well known that it would be superfluous to quote on this matter from the work; but the indifferent character of the French artillery and its inferiority to the German artillery is not generally realized. The French field artillery was composed of 4-pounder, 8-pounder, and 12-pounder guns, but the last-named were becoming obsolete as field guns, and were, therefore, in use in limited numbers only: they were placed in the Reserve of the Corps d'Armée. The Prussian guns were 4-pounders and 6-pounders.

The projectiles used were as follows:—

	Common Shell.		Shrapnel Shell.		Rounds of Case.
	Weight.	No. of rounds per gun with the battery.	Weight.	No. of rounds per gun with the battery.	
	Lbs.		Lbs.		
French 4-pr.	8·886	170½	9·403	20½	20½
Prussian 4-pr.	9·37	144	Nil		9
French 8-pr.	16·22	83½	19·29	8½	8½
Prussian 6-pr.	15·202	123	Nil		7
French 12-pr.	26·45	..	25·99	..	..

The range of the French 4-pounder common shell is a little over 3,000

mètres, but the fuze employed (a time fuze) rendered it possible to burst the shell at two distances only, 1,500 and 2,800 mètres. At all other ranges the shell had very little effect. Since at the long ranges the projectiles could only be used as solid shot, and the accuracy, besides, was not great, the rule obtained in the French Artillery, only in exceptional cases to fire at longer ranges than from 1,200 to 1,500 mètres. The fuze used with the 4-pounder shrapnel shell rendered it possible to burst the shell at four ranges, which lie between 500 and 1,300 mètres. The same fuzes were used for the 8-pounder. A similar fuze was used for the 12-pounder shrapnel bursting at four ranges between 500 and 1,400 mètres, and probably the same kind of fuze was used for the 12-pounder common shell. From the table given above, it will be seen that with only a very small proportion of the projectiles could the least ineffective fuze be employed. The Prussians used a percussion fuze, and it is stated that the third trial shot found the range. The foregoing facts should always be kept carefully in mind when considering questions of tactics connected with or arising out of the Franco-German War.

We are now in a position, therefore, to proceed on the enquiry, why, at the Battle of Gravelotte, only 5 or 6 per cent. of the casualties are due to the effect of artillery fire against 90 or 94 per cent. due to infantry fire?

According to "Die Verluste der Deutschen Armeen an Offizieren und Mannschaften im Kriege gegen Frankreich, 1870 und 1871, von Dr. Engel, Director des Königlich-Preussischen Statistischen Bureau," the losses sustained by the Germans in this battle were as follows:—

Corps.	Killed.	Wounded.	Missing.	Total.
Guard	1,959	6,016	144	8,119
IXth	1,056	3,181	200	4,437
VIIIth	697	2,550	145	3,392
Saxons	415	1,644	167	2,226
IIInd	143	965	248	1,356
VIIth	145	587	31	763
Xth	16	81	3	100
1st Cavalry Division.....	9	85	..	94
IIIrd Corps.....	9	78	1	88
Ist Corps.....	..	1	..	1
5th Cavalry Division ....	..	1	..	1
Total.....	4,449	15,189	939	20,577

From these figures it appears that almost two-fifths of the whole loss fell on one corps alone, namely, the Guard Corps. It will be instructive to learn how this heavy loss was incurred. On looking into the accounts of the battle, it will be found that the regiments which suffered most severely, attacked late in the afternoon that portion of the French position which extended from St. Privat on the north to the railway running north of Amanvilliers on the south. The 1st and 3rd Foot Guards stand highest on the list of casualties. They attacked north of the St. Privat, Ste. Marie-aux-Chênes Chaussée, and they lost in a very short space of time 1,058 and 1,090 respectively. The German official account tells us, at p. 131, 6th Section (Major Clarke's Translation): "At a short distance in front of the west and north sides of St. Privat there were several parallel walls of knee-high masonry, while at some places the adversary had thrown up shelter-trenches. These lines, successively commanding one another, were filled with compact lines of skirmishers, and in their rear, upon the commanding height, lay like a

natural bastion, and girt with an almost continuous wall, the town-like village, the stone houses of which were occupied up to the roof storey." We may here say, that from personal inspection of the ground, it is difficult, if not impossible, to get out of view of the village, on the ground over which these regiments advanced. "The (French) guns posted since the commencement of the engagement to the west and north of St. Privat were, it is true, already silenced in front of the Saxon Artillery, and had retired; on the other hand, from the south side of the village, heavy batteries swept, in the most effective manner, the ground to the north of the road. . . . As soon as the brigade reached the east side of Ste. Marie" (distant 2,800 paces from St. Privat), "an extremely heavy fire of artillery and musketry was directed from the opposite lines of the enemy against these newly-appearing bodies of troops."

Before proceeding further in the enquiry, it is well to see what the value of this artillery fire can have been, and for this purpose we will turn first to the account given by Lieutenant-Colonel de Montluisant, who commanded the Reserve Artillery of the French Corps, the 6th, now attacked, at pp. 19 *et seq.* of his work—"1870, Armée du Rhin, ses épreuves la chute de Metz." We read: "Everywhere (on the German side) there was an abundance of ammunition, the fire was incessant, concentrated, sustained, and remarkably accurate. On the French side, on the left of St. Privat, were only 6 12-pounder and 10 4-pounder guns. Total 16. On the right 6 12-pounders and 54 4-pounders. Total 60 pieces. There was no park, not a single mitrailleuse battery, and there were not more than 100 rounds per gun. Ammunition ran out only too fast; it was necessary not only to slacken fire, but to reduce it to one round every quarter of an hour, and finally to cease firing altogether, reserving 10 to 15 rounds per gun, to meet future unforeseen attacks." To the 60 French guns north of St. Privat, which had, moreover, to guard the ground as far as the Bois de Jaumont, were opposed in a mass from St. Privat to the Anboué Copses 72 Saxon guns, which, according to Hoffbauer ("The German Artillery in the Battles near Metz," translated by Captain Hollist, R.A., p. 236), were "principally occupied in subduing the fire of the enemy's guns between St. Privat and Roncourt, and in preventing him from advancing to impede the Saxon turning movement. Consequently the enemy's artillery was generally the object of our fire. . . . The practice made by these 12 batteries was excellent, and obliged the hostile artillery to withdraw." And further, p. 279: "The left wing of the Saxon artillery overwhelmed Roncourt with shell. . . . The right wing also fired with equally good effect against St. Privat, and the batteries placed north-east of that village, until at length only a few of the latter still held their ground." To the 16 guns south of the village had been opposed soon after 3 P.M. a mass of 108 guns between Ste. Marie and the railway. "At the beginning of the battle," says Hauffbauer, p. 231, "the French artillery was the principal object at which the Hessian and Guard batteries aimed. . . . The immediate result of their concentrated fire was the withdrawal of the enemy's advanced batteries to his main position, where his artillery was so strongly posted as to necessitate a lengthened cannonade, so that it was 4 P.M. before the French fire perceptibly slackened, and at 5 P.M. it died away almost entirely. After this only a few fresh batteries came into action. The left wing (*i.e.*, . . . the Artillery of the Guard) kept the hostile artillery opposed to it in check from the very first, and diverted its fire from the right flank of the infantry advancing from the south against Ste. Marie-aux-Chênes. . . . The enemy's common shells were more effective than his shrapnel, which generally burst too high; but the principal loss was caused by the Chassepôts of his skirmishers, who lay under cover in the furrows, as well as in the ditches of the high road between Ste. Marie and St. Privat."

From these extracts it is evident that the artillery fire on the 1st and 3rd

Foot Guards could not have been very severe; in fact, Colonel Montluisant, though himself an artillery Officer, and therefore naturally inclined to give the fullest credit to his own arm of the Service, attributes (p. 21) to the grazing fire of the 9th Battalion of Chasseurs at St. Privat, the check sustained by this brigade. Captain v. Kessel, in the "*Geschichte des König Pruss. Ersten Garde-Regiments zu Füss.*," says, at p. 154, that already when "the two regiments were lying on the exposed plateau, 500 paces south of Ste. Marie, the German artillery in rear were successfully diverting from them the fire of the French guns, but they were under the fire of French infantry which could not be replied to on account of the inferiority of the German weapon. Whenever mounted Officers got together the bullets were sure to fall in large numbers, and the groups had to separate. Occasionally a shell burst in their vicinity." At p. 156 we read in the account given by General v. Kessel, the Brigadier, "The Chassepôt bullet, still effective after several ricochets, disregarded the distances between the lines altogether." This grazing fire of the Chassepôt stands out forcibly throughout the narratives. The 2nd Foot Guards, which attacked somewhat later over the same ground, suffered the same fate as its predecessors, and with a loss of 1,075 men. South of the Chaussée had advanced in front of the 108 guns, to the attack of the position, the 2nd and 4th Grenadier Guards. The small force of artillery in front of them has already been mentioned. The official account, p. 128, describes this attack as follows: "Dense swarms of French skirmishers covered the slope and the ridge. On the latter they had ensconced themselves in shelter-trenches and behind hedges, which partially enclose the cross-road leading over the ridge, whilst the water channels intersecting the fields at distances of about twenty paces offered the assailant a cover which was in truth most insufficient. Even during its deployment at St. Ail, the Prussian brigade found itself overwhelmed by a shower of bullets which accompanied the advance with annihilating effect. The ground was so hard from the continuously dry, hot weather of the last few days, that the Chassepôt bullets, after striking, rebounded, and in this way still found their mark." As regards the 4th Grenadier Guards we read, p. 129, "The left wing of this attacking line of fourteen companies (including two of the 1st Grenadier Guards) was advancing partly in a direct, partly in a flanking direction against the hedged lane, whilst the extreme right wing had been deputed to turn the left of the enemy's salient position. At the signal of the regimental Commander, Colonel Count Waldensee, the whole line charged forward towards the heights. The enemy's volley firing rent the companies asunder . . . and the frontal attack at that point broke down shortly under the shower of bullets of the adversary who had apparently been reinforced by fresh troops." The part taken by the French artillery in repelling this attack is thus briefly described by Colonel Montluisant at p. 20: "The French batteries placed to the left of St. Privat resisted most energetically the advance of the enemy. Each 12-pounder shell makes a chasm, causes indescribable disorder; but, the ammunition ran short, and Prince Hohenlohe still advanced in échelon with his fourteen batteries." The losses of these two regiments stand fourth and fifth on the list of casualties, being 1,059 and 929 respectively. It may then fairly be deduced from the foregoing extracts that so many victims fell to the Chassepôt for the simple reason that it was against the Chassepôt, firing over ground most favourable for its shooting, that the victims advanced. Some must have been struck down by artillery fire, but these could not have been many, seeing that the guns were few in number, were short of ammunition, and were held in check by a superior force of guns, by which they had already been partially silenced. As regards the losses incurred by the remaining regiments of the corps, we find these attacking south of the railway, and opposite Amanvilliers where the French artillery fire had been already silenced. (Hoffbauer, p. 270.) Of the 1st Grenadier Guards two

companies had joined in the attack on St. Privat ; the other eight available companies came into action against Lorencez's entire division, about thirteen battalions strong, and further reinforced. (Hoffbauer, p. 272.) The second battalion encountered the resistance of strong detachments of infantry of Grenier's division (Official Account, p. 121), and afterwards joined in a hand-to-hand fight in the vicinity of Amanvilliers (Official Account, p. 125). In these almost purely infantry engagements the regiment lost 823 men. The battalion of Sharpshooters of the Guard (Official Account, p. 121) attacked troops well posted, came into a murderous shower of bullets poured in upon the front and both flanks of the battalion, and lost 461 men, including all the Officers. The 3rd Grenadier Guards entered here still later into action, and employed but a small portion of the regiment till nearly all was over. The Chassepôts were their enemy here, and the loss was 445 men. The losses of all the regiments of the corps have now been accounted for, and if the writers of the works named are to be trusted, the Chassepôt obtained the vast majority of the casualties for the reason before given, that it was against the Chassepôt that the attacking troops, in some cases as at St. Privat, ten men to the pace, were led. The French artillery had but a small part to play in the struggles.

It is not necessary to carry much further the analysis of the losses of this battle. The Fusilier Battalion of the 85th Regiment loses 12 Officers and some 469 men in a vigorous counterstroke met mainly by Chassepôt and mitrailleuse fire. (Regimental History, p. 27.) The same story is repeated on the right of the line approaching Gravelotte, where the 60th and the 33rd Regiments lose respectively 718 and 639 men. General Frossard, in his "Rapport sur les Opérations du 2me Corps," p. 108, says, that "the German artillery having got the better of his own guns, the German infantry were sent forward across the Mance Valley. The infantry and mitrailleuse fire stopped the advance and drove the enemy back into the ravine. Everywhere the infantry going to the attack find in the hostile infantry the means prepared to stop their further progress." Everywhere we find the same story, an overpowering German artillery fire silencing or holding in check the fire of the inferior French artillery, and the infantry regiments suffering in proportion to their efforts to advance to the assault against better armed hostile infantry, and everywhere, except in the centre, over ground singularly adapted to bring out the full powers of the superior firearm. It is hoped that this brief summary of the great battle of Gravelotte may contribute to shaking faith in the value of the Gravelotte percentages.

As regards the percentages of the campaign, I have carefully traced through a large number of the battles and engagements of the war, the part taken in each action by the two regiments whose losses were greatest, and with the almost unvarying result that I find these losses were occasioned as at Gravelotte by the troops advancing against infantry fire, the action of the hostile artillery being neutralized by the fire of the German guns. In some cases, as at Wissemburg, Worth, Colombey, Noisseville, Balan (Sedan), Bourget, Champigny, Etival, Dijon, Amiens, and la Hallue, the losses were incurred in village fighting, or the storming of heights.

From this enumeration the great battle of Vionville has been omitted because it requires special notice, as it appears to be a remarkable illustration of the enormous physical power of artillery, good in its material, and properly handled. But although I attach little value to the medical returns of percentages, yet if they are used against artillery they may also be used in its favour. In the note in Thival's work already quoted, the French percentage of losses in the campaign is thus given : 70 per cent. infantry fire, 25 per cent. artillery fire. This is something very different from the German Gravelotte percentage, and yet it is always ignored, or more probably it is not generally known. The facts of the battle of Vionville strongly support this statement

of the effectiveness of the German artillery fire. In giving a summary of this battle I have endeavoured to show the overwhelming preponderance of the French forces at different times of the battle, and the small destructive effect that could have been produced by the few German infantry compared to that produced by the German guns. The summary is taken from the official account, 5th section (Clarke's translation), my own "Tactical Studies," founded on it, and from Hoffbauer's previously quoted work.

The battle commenced at about 9.15 A.M. by the almost simultaneous entry into action of five German horse artillery batteries, the four on the left being separated from that on the right by a distance of about one mile, cavalry being the only escorting or protecting force. Shortly there came up into the interval the four batteries of the 6th Infantry Division, making a total of 54 guns ; but by 10 A.M. all, save one battery (that on the left), had to retire before the advance of the overwhelming infantry forces opposed to them, the only German infantry on the ground being two battalions of the 5th Infantry Division advancing on the right towards the Bois de Vionville. The French guns now coming into action are—

Lepasset's brigade 5th Army Corps....	6 battalions,	6 guns.		
2nd army corps (Frossard)	26	„	60	„ 12 mitrailleuses.
6th „ „ (Canrobert)	40	„	36	„
Total,—	72 battalions,	102 guns,	12 mitrailleuses.	

Of these, Tixiers's Division of the 6th Corps, numbering 13 battalions and 18 guns, were only gradually brought into action ; the others were actually on the ground at the commencement of the fight. The French had at once moved forward, and were at 10 o'clock in possession of Vionville and Flavigny. At 10.15, however, the 1st Light Battery made its appearance on the battle-field on the left of the before-mentioned two battalions. It was overwhelmed by the enemy's bullets before it came into action, three guns were temporarily disabled, and the infantry, now three battalions, was fighting against the French Infantry in the wood. The three uninjured guns opened fire at a range of from 800 to 1,000 paces, and with such effect that the dense swarms of skirmishers were crushed, and obliged to retire. The three other batteries of the division now came into action on its flanks. Two battalions enter successively into the battle, in an isolated fashion, on the left of the guns ; but little help can they give. The first to arrive was the Fusilier Battalion of the 48th Regiment. Of it, three companies suffered at once such heavy losses that they had to retire in complete disorder to the Bois de Gaumont : of the next, the 1st Battalion of the 52nd, all the Officers were in a short time placed *hors-de-combat*, and the remainder had to retire to the valley in rear. But in the centre and on the left, affairs are progressing favourably. The artillery, reinforced by two fresh batteries, has, with one exception, come into action again. On the left the twelve battalions of the 6th Infantry Division have been brought on to the field in divisional formation, and are engaged in attacking the villages of Vionville and Flavigny, and in extending the German line still further to the north. By 11 A.M. the Germans have on the field, and nearly all actively engaged, 84 guns and 19 ($18\frac{1}{2}$) battalions. During the next hour this force is increased by the arrival in the centre of the 24 guns of the Field Division of the Corps Artillery ; whilst on the right 4 battalions of the corps, 2 battalions and 6 guns of the Xth Army Corps, and on the left, $3\frac{1}{2}$ battalions and 6 guns of the latter corps take part in the struggle. At noon the German force consists of 126 guns (the disabled battery having rejoined the line), and 29 ($28\frac{1}{2}$) battalions. Assuming that the 72 French battalions are numerically equal to only 54 German battalions, the Germans are terribly overmatched in this arm. But the result of the fight so far has been that the force weaker in infantry has established itself on a line some three miles long from near the

Roman Road on the north to the Bois de S. Arnauld on the south, has already captured the two villages already named, and in front of its right where its infantry were fewest, have driven back a whole French Corps, with a loss to the defeated of 4,327 out of an effective of 19,000 men. The losses, Frossard, the Commander of the Corps, attributes at p. 97 of his "Rapport" to the very heavy artillery fire (*un feu d'Artillerie des plus intenses*). By 3 P.M., when the battle entered its last great phase, the Germans counted 156 guns, and an additional battalion, whilst on the French side 3 Divisions of the 3rd Army Corps, and 2 Divisions of the 4th Army Corps, were coming into action, and the place of Frossard's Corps had been filled up from the Guard Corps. By the close of the battle there had come up into the German line 72 more guns and 32 more battalions, making a total of 228 guns and 61 battalions, 5 of which, however, belonging to v. Wedell's Brigade, had been defeated, after some half hour's fight, with a loss of about half their strength, and driven off the field by the freshly arrived troops of the French 4th Army Corps. At the close of the battle the French forces available, allowing for the absence of two Divisions and the reserve artillery of one corps, could not have been less than 161 battalions (=120 German battalions), 378 guns, and 54 mitrailleuses.

It is impossible to ascertain the exact number of guns or battalions which took an active part in the struggle on the French side, but we know that every gun and almost every battalion on the German side was under fire, although some for a short time only at the latter part of the day. But whilst the defeated battalions of Frossard's corps were at once replaced by fresh battalions drawn from the Guard Corps, and the infantry struggle was carried on as vigorously as ever in this part of the field, so far as the French were concerned, two battalions of the 5th Infantry Division on the right centre, and five battalions of Wedell's Brigade on the extreme left, were practically put out of the fight with enormous losses soon after they appeared on the field of battle, and could not be replaced. The loss of these battalions was a serious deduction from the German rifle fire. The battle was one in which both sides were equally on the offensive and the defensive, entrenchments were not employed on either side, and the struggle was fought out on similar conditions as regards attack and defence. But of the two man-killing weapons employed by each combatant, one was as superior, as the other was inferior to those in the hands of its foe. It follows, therefore, that inasmuch as the inferior rifle was in the hands of the numerically inferior infantry, the losses inflicted by the numerically inferior infantry on its opponent must have been far less than that it sustained at the hands of the numerically superior infantry, armed with the superior rifle. Yet, looking at the losses inflicted by one on the other, we find that whereas the French, with their Chassepôts, and indifferent artillery, inflicted on the comparatively small force opposed to them a loss of 14,825 men, these Germans, strong in their artillery, but deficient in infantry, put *hors-de-combat* 16,985 French soldiers. The inference is obvious (and is confirmed by Frossard's statement before mentioned), and is, that a very large percentage of this 17,000 men must have fallen under the fire of the German guns. I have purposely abstained, save in one instance, from quoting from Hoffbauer's work, details of the successful employment of the German guns. Artillery Officers naturally are inclined to attribute much of the results of a victory to the working of their own arm, but making allowance for any amount of pardonable exaggeration, his account of the battle affords indisputable evidence of the physical effects of artillery on the 16th August, 1870. It is hoped that enough has been adduced to lead Officers to discard in future the use of these German medical statistics in considering the relative value of infantry and artillery fire, as instruments of destruction, or in evidence of the small physical effects of artillery.

To some it may seem that it has been a waste of labour and time to analyze battles for the purpose of showing that the chief part of the losses incurred in action must be caused by infantry attacking infantry.

If the statistics which have served for the text of this article were employed in tactical discussions simply as illustrations of that most obvious fact, these remarks would never have been put on paper, but the truth is that they have been, and constantly are used in depreciation of the power of artillery, and for this use I maintain to the utmost that there is, from the historical point of view, no warrant whatever.

On the 16th August, 1870, on the field of Vionville, long-armed A commenced an encounter with long-armed B and his ally short-armed X, the latter being a big boy. Little short-armed Y, half the size of X, came to the assistance of his friend A; and at the end of the fight, B and X were found to be much more knocked about than were A and his little friend Y, and for this satisfactory result, Y was duly grateful.

Two days later, little Y having grown a good deal, went hammer and tongs at his old opponent X, who got snugly behind walls and hedges and banks, where A could not get at him. Moreover, A and B had accounts of their own to settle, and paid little attention to their friends' fight. X and Y hurt each other very much, and ever after ungratefully abused their long-armed friends for cuffs and bruises which arose merely from their own wish to settle accounts between themselves.

But in conclusion there is yet a strong reason, in fact the strongest possible reason, why these statistics should be relegated to the forgotten past, and that is that the artillery which furnished the practice on which they are founded are obsolete. French and Germans alike, when they next meet in a campaign, will come with weapons and projectiles so superior to those employed during the Campaign of 1870-71, that the experiences of that war will be useless for practical purposes and practical soldiers; and still more antiquated will assuredly these results appear to be, still more unreliable, when they are contrasted, as some day they may be, with the practice obtained by our own artillery, firing their steel shells from the 12½-pounder field gun.

A SHORT HISTORY OF THE IRON-CLAD TRAIN.

By Lieut. E. WARRE SLADE, R.N.

THE object of this paper is to give a short account of the construction of the iron-clad train which attracted so much attention during the recent war. This is, I believe, the first time that a gun as heavy as a 40-pr. has been mounted and fought on a railway truck. Trains were utilized as a means of reconnoitring during the American war of Secession, and during the war of 1870-71, but, as far as I can ascertain, no heavier guns than those usually employed as field artillery were mounted on them. Unfortunately the 9" gun was only got ready for action on the day that Kafr-Dowar surrendered, so that there was no opportunity of trying it against the enemy. It was, however, fired across Lake Mareotis and everything worked satisfactorily, so there is every reason to suppose that it would have been most successful against the enemy's works.

After the occupation of Alexandria by the Naval Brigade, the railway naturally attracted great attention, both on account of its enabling us to move men to the front with speed and facility, and also on account of the advantages which it gave to the enemy for suddenly making a strong attack on our position.

In order to guard against this latter contingency, the first train went out with a party to destroy the line between Gabari station and Mehalah junction. Lake Mareotis was at this time covered with water, and it was proposed to float a raft carrying Gatling guns on it in order to turn Arabi's position, and also to flank any offensive movement that he might make against the town.

A second party was, therefore, sent out to reconnoitre and ascertain whether there was sufficient depth in the lake for that purpose, but as only a few inches of water covered the mud, the raft plan had to be abandoned.

As we pushed our advanced posts to the front the line was repaired, and a number of trucks were shunted through the junction to the Moharrem Bey station, in order to clear the Gabari station. The enemy, however, cut the line during the night, and on the next trip the engine went off the rails, effectually blocking the down line.

Captain Fisher ("Inflexible") then proposed to use the train as a regular means of reconnoitring, mounting machine and field guns, and protecting the engine against rifle-fire. Besides the Gatlings which had been used on former occasions, a Nordenfelt and two 9-prs. were added to the train. The sides of a truck were built up and strengthened with thin iron plates so as to form a protection to the crews of the 9-prs., which were placed on the truck with their limbers, so that they could be used as field artillery if necessary. Sand-bags were hung round the boiler of the engine to protect it from injury, and it was placed in the centre of the train. A truck carrying a steam crane came after the 9-pr. truck, for the purpose of lifting the guns off if required. A couple of spare trucks were put in front of the train, so that they could be pushed ahead and explode any mechanical mines that might have been placed under the rails. These trucks also carried spare railway iron, chairs, bowls, &c., for repairing the line. Besides these, there was a truck loaded with gun-cotton, detonators, Bickford's fuzes, &c., for destroying the line if necessary; a truck for the covering party, and a truck with a Gatling gun in rear of all.

The train thus constructed ran for some days, but as the enemy increased the strength of his works, it was found necessary to increase the strength of the train. Captain Wilson ("Hecla") proposed using heavier guns, and offered to land the "Hecla's" 40-pr. bow gun. The original idea was to place the gun on a truck and take it out with the train until within effective range of Arabi's works, then lift it off by means of the crane and fight it from the ground, leaving the train free to advance or retire. This was done at Mex for trial, and gave very fair results, but the process of mounting and dismounting entailing so much extra work under fire, it was decided to try the experiment of firing the gun from the truck itself. A baulk of timber was bolted to the fore part of the truck for the pivoting bolt, and a racer was laid down in rear, the breeching was secured to bolts in front, and the training tackles to iron spurs projecting about two feet on each side of the truck. The gun was protected by a packing case for a 500 lb. mine filled with sand, and with an iron plate bent round it, placed under the breast of the gun, and the spaces at the sides filled up with sand-bags. The shells were in the hinder part and covered with a plank to prevent injury. Against the hinder part was an arm rack for the men's rifles, with places for a glass, spare vent piece, &c., directors and measuring lines for range finding, and semaphore flags. Telescope sights were improvised in the following manner: an ordinary 2-foot Ross' telescope was fitted with cross wires, and a batten with V pieces were fastened to the fore and rear sights. The telescope was placed in these, and the gun laid by it; the telescope was then removed before firing. Great difficulty was at first experienced in seeing accurately where the projectiles pitched, so a ladder twenty feet high was made which could be erected in the ammunition truck, from the top of which a look-out could be kept.

The gun thus mounted first went into action on the 5th of August, and the results obtained exceeded the most sanguine expectations. No straining was

9 INCH M.L.R. GUN MOUNTED ON A RAILWAY TRUCK.

FIG. 1.

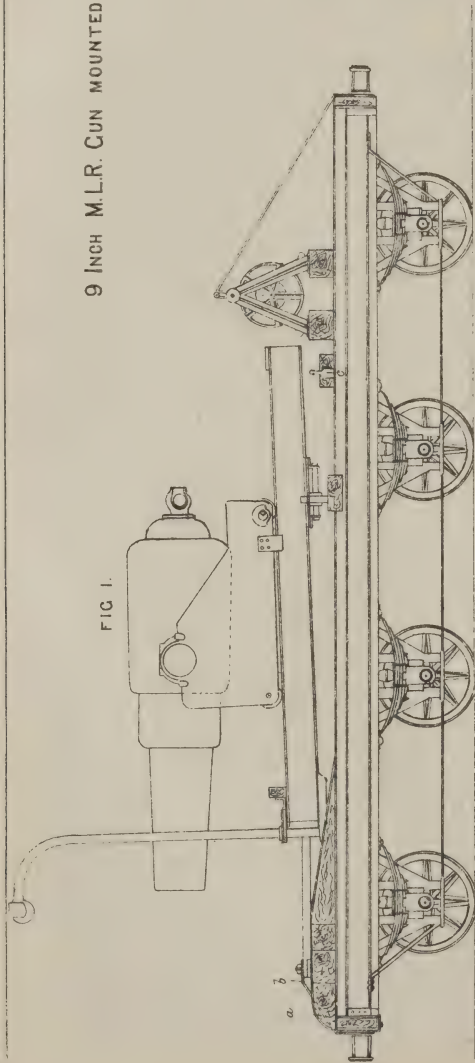


FIG. 3.

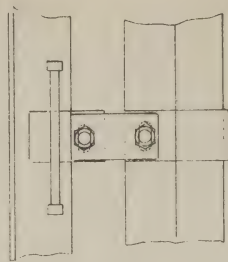


FIG. 4.

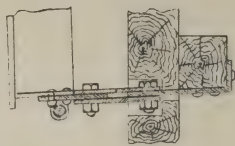
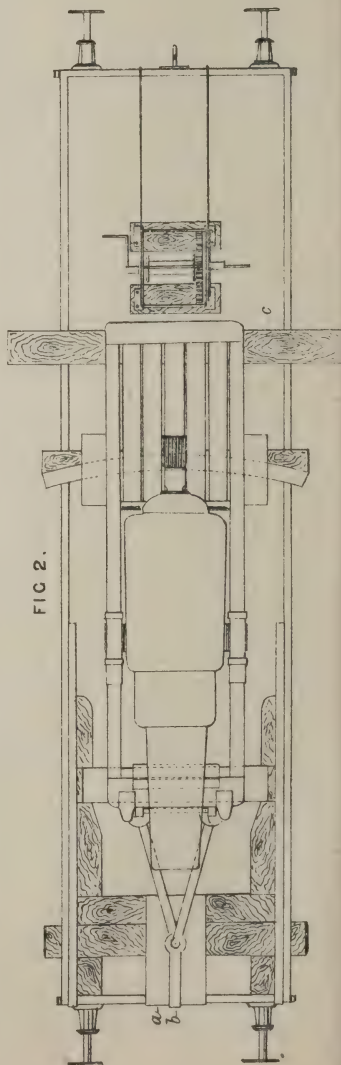


FIG. 2.



SCALE OF FEET.



FIGS 3 AND 4 ON DOUBLE THE SCALE.

discovered in either the truck or rails, and the recoil of the truck was almost nothing. Several arrangements were tried as to the best way of making up the train, and eventually the following was decided upon—

- 1st truck, empty, so as to guard against the line being mined.
 - 2nd truck, a Nordenfellt gun in front, spare rails for repairing the line.
 - 3rd truck, spare rails, bowls, chairs, &c., for repairing the line.
 - 4th truck, 40-pr. gun and crew.
 - 5th truck, ammunition wagon. This was protected all round by thin iron, and the magazine was covered in front by a pile of short railway iron, a little higher than a powder-case. On each side was a baulk of timber, and on top a layer of rails, three or four of which were bolted down. The powder was in half metal-lined cases. This truck also contained fuzes, tin cups, tools, four cases of wet, and one of dry gun-cotton, Bickford's fuze, detonators, lantern and candles, slings for lifting the guns and carriage, bearers for the gun, a collapsible boat, stretchers, and arm racks for the covering party of twenty-eight men.
 - 6th truck, protected with thin iron plates, carrying two Gatlings with their crews.
 - 7th truck, two 9-prs. with their limbers, two 7-prs. and their crews.
 - 8th truck, steam crane.
 - 9th, engine, protected with railway iron laid horizontally along the boiler, $\frac{1}{4}$ " and $\frac{3}{4}$ " iron plates round the working parts, and sand-bags.
 - 10th truck, protected by iron plates, carrying the covering party and with a Gatling in rear.
- A reserve engine always followed, usually on the other line, and if necessary brought up another train with a battalion.

Later on another change was made, and the magazine truck was sent to the rear with the reserve engine, sufficient ammunition for ordinary use being carried on the gun truck.

At first, when the train went into action, it all remained under fire, but latterly the spare trucks and 40-pr. were pushed to the front, and the remainder retired out of action. Drag ropes were fitted to the 40-pr. truck and manned by the guns' crew under cover of the embankment, by which the range could be altered after each shot from the enemy, and so, as it were, dodge his shells.

The 40-pr. was manned by a gun's crew from H.M.S. "Hecla," under Lieutenant Davison, and the other guns by men from H.M.S. "Invincible," under Lieutenant Poore, the whole train being under the command of Commander Henderson ("Invincible").

When the 15-centimetre gun was mounted at Kafr-Dowar, it was found necessary to withdraw the train during the daytime, and it was only used after nightfall for patrolling the line. Lieutenant Davison then asked permission to mount a heavier gun; but as the only 7" guns in the place were in position at Ramleh, and the 8" guns were all destroyed, there were only some 9" and 10" guns available, and it was at first thought to be impracticable. Admiral Dowell, however, eventually gave him permission to try the experiment, and as far as could be judged, it proved a success. A truck, which had been constructed some time back to transport a 26-ton boiler from Alexandria to Suez was found in the store, and appropriated. It was longer than the ordinary trucks, and much stronger built, running on eight wheels close together and with especially constructed springs. He then went out to Mex with a spare truck, the steam crane and an engine, and with his gun's crew of twelve men he parbuckled a 9" Armstrong M.L.R. gun from where it was lying on to the railway, a distance of 150 yards, hoisted it into the truck, and brought it in the same day. The next day a carriage, and the third day a slide were procured from the same place. The pivoting bolt

and racers were obtained from the same fort, by blowing up some of the *débris* and digging them out from where they were placed in position. As all these different parts belonged to different guns, some little difficulty was experienced in making them fit each other, but with the assistance of some carpenters from the "Invincible," and the workmen at the Gabari railway works, who were placed at his disposal by Mr. Carlisle, the manager, the gun was mounted. Three baulks of timber were placed across the fore part of the truck and bolted through the floor. A $\frac{3}{4}$ " iron plate, 2' wide, was bent over these and bolted to the bottom of the truck, and in the centre of this platform the pivoting bolt was placed (Fig. 1a). As a further support another piece of $\frac{3}{4}$ " iron, 4" wide, was fixed to the top of the bolt when the bars were in position, and also bolted under the carriage (Fig. 1b). The slide, which was of the land service pattern with high rollers, had to be cut down so as to bring the weight as low as possible. The rollers were taken off and the axletrees cut. An extempore rear-axle was made out of a bar of iron, and the rear-rollers of a 10" gun carriage were used as rear-slide rollers, the fore part of the slide working without rollers, on an iron skid plate. The rear-rollers were so far forward that the slide was very liable to tip up when the gun recoiled, in fact, several guns were disabled in the forts during the bombardment in this manner. An arrangement, was therefore, fitted to the fore part of the slide which prevented this, and, at the same time, allowed lateral motion to the slide for training (Figs. 3 and 4). In rear of the rear-slide rollers, a baulk of timber was placed, projecting about two feet on either side with bolts for the training tackles (Fig. 1c). When the gun was out and the training on, a wedge was driven in between this baulk and the rear of the slide, so as to take some of the weight of the gun on recoil off the rear axle, which was rather weak, and also to distribute the weight more evenly over the truck. In order to run the gun in, some sort of a purchase was necessary, and nothing could be found to answer the purpose better than the crab of the Moncrieff gun at Fort Ras-el-Tin.

The gun was then mounted by a crane, and everything worked satisfactorily. About 5° of training was obtained on either side, which in this case was sufficient to cover the principal works at Kafr-Dowar, particularly as there was a sharp bend in the line, and a very much larger arc could be covered by a judicious selection of points to fire from.

During the whole time that this gun was being mounted, the train with the 40-pr. and other guns went out every night to patrol the line, remaining out all night. This duty, going on at the same time as the men were employed mounting the 9" gun, made the work very harassing, but, notwithstanding this, the work was completed in eleven days.

After Kafr-Dowar was evacuated, and matters had quieted down somewhat, it was decided to try the gun in order to see what effect it would have on the truck and rails.

The gun was taken out to a clear part of the line outside the Gabari station, Lord Alcester, Vice-Admiral Sir W. M. Dowell, Captain Molyneux, Captain Wilson, and other Officers accompanying it to witness the trials.

The gun was pushed ahead with its magazine truck in rear of it to lessen the recoil, while the train retired about 500 yards. A scaling charge of 15 lbs. was first fired, then a 30 lb. charge with common shell, and then a 50 lb. charge with a Palliser shell at the extreme training the truck would admit of.

After each round the truck and rails were most carefully examined, but no sign of weakness could be discovered anywhere. The recoil of the trucks was about 20 or 30 feet, but that might be lessened by putting more weight in the magazine truck.

The trials were then discontinued as one of the telegraph wires was blown away. This accident, which would have been probably of no account if the gun was in action, caused the Admiral to give the order to cease firing, as the

telegraph was then in working order, and it was not deemed advisable to run the risk of doing further damage.

During the whole war the railway officials gave every assistance in their power, some of them going out with the train every time it went into action. The engineering staff, under Mr. Redmond, gave most valuable assistance in mounting the 9" gun, reducing Lieutenant Davison's rough plans to scale, and working them out. In fact, without them the work could never have been done in the time. The enclosed diagram is from a sketch done by the draughtsmen at the Gabari works after the gun was mounted.

I am greatly indebted to Captain Wilson and Lieutenant Davison, who supplied me with the notes and information from which I have been able to compile this account. I have not gone into the details of any of the actions in which the train took part, as they do not come within the scope of this paper, but really form part of the general history of that part of the campaign which took place round Alexandria. I regret greatly that I have been unable to obtain any references to the employment of trains in this manner in previous wars, as they would have formed a most interesting addition to this paper. Although the 9" gun was not put to the test of an action with the enemy, yet there can hardly be a doubt that it would have stood it well, and that in a future war a gun mounted on this principle, perhaps not as heavy a one as 9", would be a very valuable addition to an army advancing along a line of railway.

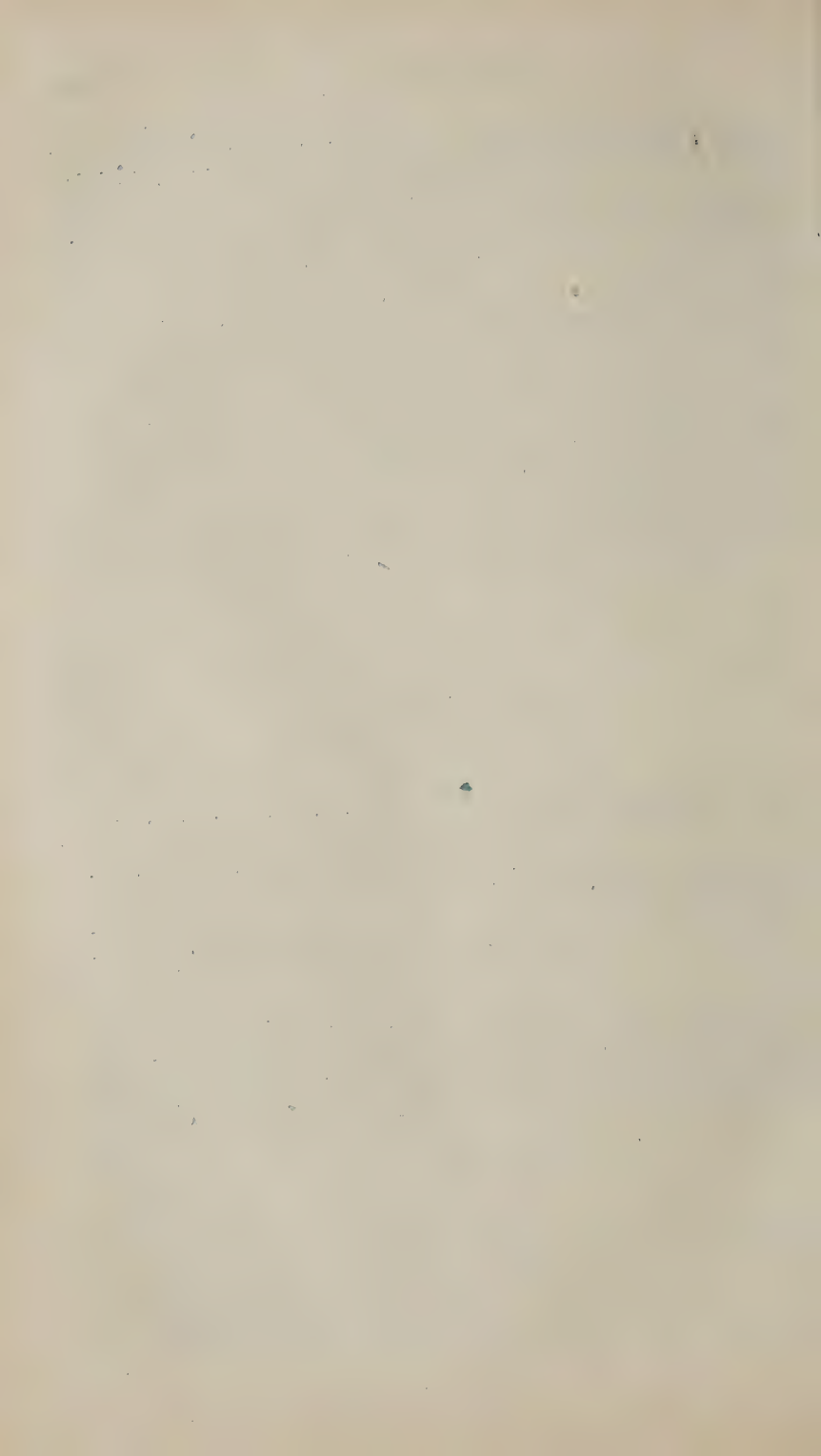
NOTICE OF BOOK.

L'Année Maritime. Par Henri Durassier. Paris. Challamel Ainé. 1883. Pp. 424. Size $7\frac{1}{2}'' \times 5'' \times 1\frac{1}{2}''$. Weight $1\frac{1}{4}$ lbs. Price 3 fr. 50 c.

This useful Review of the principal occurrences which take place during the year in the French and other Navies commends itself to all who wish to keep themselves informed on naval matters.

A special feature of the present volume is an interesting and detailed account of the French Expedition to Tunis in 1881, taken from official documents, and the conclusion of the history of the naval operations during the war between Chile and Peru.

Chapter II deals with organization and personnel, and gives a useful summary of the various Naval Budgets. Chapter III comprises a nominal list of the armoured ships of different Powers, with details of their gun power, armour, and speed. Under the heading of Artillery will be found a valuable study by Captain Rocard, of Coast Batteries. Recent torpedo experiments are noticed, and the volume closes with the text of the Law of 1881, relating to the French Mercantile Marine.



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LIEUTENANT-GENERAL SIR ARTHUR J. HERBERT, K.C.B.,
Quartermaster-General, in the Chair.

MOUNTED MARKSMEN, AND THE DISMOUNTED SERVICE OF CAVALRY.

By Lieutenant G. HAMILTON, 14th Hussars.

MILITARY authorities of leading European nations agree that an army possessing a large number of mounted men capable of being used as infantry has an incalculable advantage over one that has them not.

Of late years, whenever we have gone to war a force of mounted marksmen has been in demand. This force has always been raised hastily by contribution from the different infantry regiments on the spot, and mounted on whatever animals were available. The Officers have been furnished in the same manner. Officers and men rejoin their respective regiments on the termination of the war; there is no time for any perfect system to be worked out, and they are too short a time together to admit of much organization. Being so hurriedly got together, men, Officers, horses, and equipment look, and are, a very scratch pack. A great deal of expense is entailed in equipping this force, and regiments that contribute the men are thereby unexpectedly weakened at the most inconvenient time. Still, imperfect as is the state to which they have hitherto attained, it is acknowledged that a body of mounted marksmen is invaluable to an army in the field. A force to meet this call should therefore be raised in time of peace, when it can be properly trained, its imperfections eradicated, and its organization perfected.

The manner in which mounted infantry, as at present organized, are or should be utilized, is by advancing them (under cover if possible) on a desirable position, and when dismounted opening fire. If threatened by cavalry or otherwise, they mount and retire; harassing the enemy by repeating the manœuvre in whatever direction it may be advisable to do so, as frequently as necessary. Their sole arm is their rifle and bayonet. They cannot be used as cavalry, because they have no swords or lances, and they are not sufficiently trained to

undertake outpost duty effectively. The horses become mere conveyances for advance and retreat, with the object of keeping the men fresh and unfatigued, and enabling them to move quickly from point to point. Generals on service, finding it necessary, besides cavalry and infantry, to have a cross between the two, have hitherto had to be content with mounted infantry, a body which is lacking in some of the most essential characteristics of both the older branches of the Service, without proportionate corresponding advantage.

This is wasted economy. By proper organization, a force fulfilling all the duties of mounted infantry, combined with the power to act as cavalry, can be constituted. To do so, the material used should be that branch of the Service which can furnish men who have already acquired the greatest amount of the necessary training, and are likely to be most intelligent. Consider which requires most training, a cavalry or infantry soldier? It takes double the time to complete the training of the cavalry soldier, and when he is trained double the amount of knowledge should have been acquired by him.

Again, for what branch of the Service is the difficulty of obtaining recruits least experienced, and which contains the most intelligent men? Cavalry. One reason is, when recruits with any self-respect, pride, or conceit (call it what you like) about them decide on enlisting, they choose regiments the representatives of which they have seen walking about in the neatest looking, most picturesque, or ornamental clothes. This is why cavalry, Guards, Highlanders, and other smart corps get, as a rule, a slightly better and more intelligent class of recruits.

Before going so far as to equip cavalry regiments as mounted marksmen, as objection to so doing would undoubtedly be raised, steps should be taken to settle the question, if it be a question, whether or not it is possible for cavalry to perform their own duties as they do now, and substitute for their present inefficient dismounted practice the duties of mounted marksmen.

This can be done with ease, and at but a trifling expense, by raising a corps, or still better two or three corps of moderate size, say 600 men each, composed of drafts from cavalry regiments. They should, of course, all be selected for general smartness and good shooting, though it would not be necessary to pick all the best men in each regiment. Obtain the horses from the same source.

The armament should be a rifle carried on the saddle, except in the vicinity of the enemy, when it should be carried on the soldier's back; a bayonet always carried by him strapped to his waist; and a sword strapped to the saddle close to the near shoe case—it would, if carried by him in the usual manner, only encumber him when dismounted; he only requires it when mounted, so why should it leave the horse?

Some Officers who have served with mounted infantry say the rifle should always be carried strapped on the soldier's back. I think this is a mistake. If they had ever tried it during a long ride at the beginning and end of a day's shooting abroad, they would have found it most fatiguing. Besides, it is useless. In any case the horse carries both, so why should it be borne by the man until likely to be wanted? The rifle should usually be carried attached to the saddle on the

off-side of the horse. In action, or even on approaching an enemy, it should invariably be slung on the man's back. The present sling used is unsuitable, being too loose, and one must be made on another principle. The sling submitted to the Horse Guards by Colonel Mackenzie, 3rd Bengal Cavalry, is one of the best in existence, it is better and more comfortable in every way than any other: it is only meant for the carbine, but I can suggest a slight improvement, which would render it suitable to a longer weapon.

It would be a question for consideration whether the trial force, once formed, should be kept up by drafts of horses and men from cavalry regiments, or whether it would be best to enlist recruits specially for it. There are reasons for and against both systems. Among those in favour of the former is that by this means you would always make sure of getting proved good shots, and having to devote no time to training recruits and young horses, more could be given to other duties. But I think it would be found, for other reasons, more satisfactory for each corps to have the training of their own men and horses.

The Officers should be appointed from cavalry regiments for the same reasons that apply to the men, namely, that they have acquired by their training a wider knowledge of many of the most important duties of mounted marksmen, and because the training of infantry Officers accustoms them to work mounted men in too contracted and slow a manner; because also, the latter would not so readily grasp the feasibility of extracting the greatest possible amount of information to be acquired with the help of mounted men as the eyes and ears of an army in outpost duty, &c.; neither are they thoroughly acquainted with that knowledge, without the pre-eminent possession of which the efficiency of a cavalry regiment is greatly lessened, *stable management*.

A fault in the generality of cavalry Officers is that they are inclined to confine their movements too much. Cavalry regiments are not worked on a sufficiently extended scale; they are constantly worked in a too limited space—a field, perhaps. You may see corresponding regiments in other countries—not only the so generally quoted Germany—taken out and efficiently worked over twenty miles of country. Certainly their horses do not look so sleek as ours, but we cherish our horses too much. Some Colonels almost have a fit if five fresh horses are reported unfit for duty after a field day. This does not clash with what I say about stable management. Let the horses be thoroughly cared for when in the stable, but when out much more work should be extracted from them, and they should be cast with greater freedom when unserviceable. Make the fit horses earn their food, and cast the cripples.

With few exceptions, whenever they have had command of a mounted force, the above-mentioned fault of too limited a scope of action applies to infantry Officers, except that instead of using a field they use half a field. I, of course, only wish to point out that the system of drill and tactics learnt by infantry Officers is not of the style to fit them generally for a command of this kind, though some few might be mentioned who are naturally cavalry leaders. One qualified infantry Officer should be appointed to each corps temporarily to

assist in the instruction of that part of the drill necessary to render the force effective when acting as infantry. The corps should acquire a sufficient knowledge of infantry drill to ensure their efficiency as infantry in the field, should they be called upon to act as such. But this instruction should be strictly confined to necessary practical movements. No time should be wasted on unnecessary parade movements, &c.

The force being constituted and armed as above, it only remains to show how they can be used, as cavalry, or when necessary, as infantry, according to circumstances.

Little need be said about their efficiency as cavalry. They are similar to any other cavalry regiment, Officers and men having acquired the same training.

They are fully qualified to act as infantry, should they be called upon to do so, at any moment, as by this time we will presume they have acquired the necessary amount of infantry drill. The Colonel, on receiving an order to the effect that his regiment is required in their capacity as infantry, dismounts the required number—half, two-thirds, or three-fourths of his force. In most cases it would be unnecessary to use more than two-thirds. One man in every three, in this case, would remain mounted, and lead the other two horses wherever directed. The number of men to be dismounted for infantry purposes would entirely depend on circumstances. One man can generally ride one horse and lead two; in some cases he could lead three, but three to lead are rather a handful if they are inclined to be troublesome. If the dismounted party should be required to act as infantry till their return to camp, the mounted party, if desirable, could return there immediately, and water, feed, and groom the horses. If their services were only temporarily wanted, the mounted portion should follow the regiment at whatever distance ordered until required.

Let us now have a look at the dismounted men. They are formed up as infantry; they have each a rifle and bayonet and sixty rounds of ammunition, and a pair of boots in which they can do as much walking as any other infantry soldier; they have breeches and gaiters and a loose service coat without any stock or padding; they are thoroughly drilled, and, having left their spurs in their wallets, forget what their horses look like, and feel as independent of them as any other foot soldier. In what manner, may I ask, has a similar number of any other infantry the advantage of them?

Little need be said to point out the facility with which they can act as mounted marksmen. They can perform all the duties mounted infantry have hitherto been required to perform with only one difference, viz., that being well organized, equipped, and mounted, and being accustomed to drill and work together under their own Officers, they will perform them with double the confidence, and consequently twice as well. Time will prove that there are other ways in which this force will be able to act as no other force can.

Suppose, for instance, there is a small position occupied by an enemy, say on a hill a couple of miles off, the approach to which is

bare of cover. Infantry attacking would be under fire a long time, and if they crossed the intervening space quickly, would be blown on arriving at the foot of the hill. In fact, it is a nasty place to approach.

Attack it with cavalry equipped so as to be serviceable as infantry. Divide them into three large squadrons. The attack is made simultaneously—front, right, and left; they advance in extended order, with scouts well in advance at a gallop. Increasing their pace till near the hill, they rally and dismount two-thirds or three-fourths, as the case may be, at places chosen by the squadron leaders, who, once started, should maintain sole command until the regiment is once more combined. They should time their advance so as to arrive simultaneously; the Officer commanding the squadron of direction should watch and be watched by the others so as to accomplish this. Having dismounted, they should carry the position with a rush. The advantage in this case is that, instead of infantry having to advance two miles at a slow pace, under fire and wasting time by firing themselves, and arriving blown and tired, their effort still to be made, they would arrive fresh and keen, and having suffered comparatively slightly from being under fire. It is astonishing how easy it is to miss an object approaching at a great pace, and, remember, they are in extended order during their advance.

Musketry.—At least one Officer per troop should have gone through the course of musketry at Hythe, and the remainder should do so as soon as possible. Ranges should be erected so that the whole regiment could practise at the same time, each troop on its own range, under the troop Officers. In this manner the amount of work that usually takes eight weeks can be done in one week; and instead of cramming all the rifle practice into a limited time, it would be far better if the whole regiment were taken for that purpose once a week, or at any rate once a fortnight.

The incessant practice at ranges where the distances are known should be considerably varied by practice at unknown distances; in action men have to form their own opinion as to the distance of their adversaries, the enemy are not in the habit of carrying about placards giving accurate information as to their distance, correcting the placards as their distance varies; so men taught only to shoot at ranges where they know the distance are much at fault when they are thrown on their own resources. A difference should be made in the amount of practice compulsory for a proficient marksman and for a bad shot. When men attain a high standard of proficiency, their attendance to a certain number of target practice parades should be voluntary. Men who shoot badly should be paraded oftener for target practice.

It may be said that it will not be easy to get these men to shoot as well as if they were infantry soldiers. I beg to differ. Rifle shooting is simply a matter of practice. If you take fifty men out of an infantry regiment, and the same number out of a cavalry regiment, and let them shoot against each other, the infantry will beat the cavalry for two reasons; first, because they have more practice, and secondly, because they have a better weapon. But let them be given similar weapons, and similar training for a few months, and the

shooting will be equal. As a matter of fact, I once saw a match between a team of cavalry and a team of infantry who rather fancied themselves, which turned out very unexpectedly. The match was seven shots at 200 yards, seven at 500, and seven at 600 yards, cavalry using carbines, infantry rifles. The result was in favour of the cavalry team. The teams then changed weapons, the result again being in favour of the cavalry. I need hardly add that that team was very well trained. Of course this is exceptional; but it proves what I say, that shooting entirely depends on the system of training. Most men, before joining any branch of the Service, have never fired a rifle. Those prove the best shots who practise most. For this reason only, and because they are armed with a better weapon, do infantry shoot better than cavalry. It may be said that mounted men cannot devote sufficient time to attain proficiency in shooting. I think they can. It entirely depends on the system employed.

With regard to the best rifle for cavalry, though I do not allow that they cannot carry the Martini-Henry rifle if it is impossible to provide them with an equally effective shorter weapon, if a rifle can be made something between the carbine and rifle in length with as good shooting power as the rifle, it would be a more perfect arm for cavalry. It might be made more on the Express principle, a large charge of powder and perhaps a slightly smaller bore, say .400 instead of .450. This ought to give a much flatter trajectory up to 500 or 600 yards, and be equal to if not better than the rifle at greater distances. Perhaps if the bullet were too small or light, the wind would affect it after 600 yards; this should be guarded against.

Were it decided to-morrow to equip cavalry with a new rifle, a little shorter and consequently more portable than the Martini-Henry, in all probability, owing to the usual delay, two or three years at least might elapse before it was served out: it would therefore be advisable to arm the trial corps with the present rifle until one more suitable can be issued. It would be a great point gained if cavalry and infantry possessed the same rifle and ammunition, as by this means all complications with reserves could be avoided.

Though late wars have shown that but little execution is done at much over 500 yards, we must have 300 or 400 yards in hand in whatever rifle we use. Suppose, for instance, that because the present cavalry carbine shoots very well up to 500 yards, we arm our cavalry to act as mounted marksmen with it, how should we feel if we found ourselves opposed, say to an Austrian Army, whose cavalry were armed with a rifle as good at 900 yards as ours at 500 yards?

No! our cavalry should have a better weapon; one with which they can hold their own.

A magazine rifle with equal shooting power to the rifle I have suggested would be a good weapon. It is stated that men so armed are apt to fire too quickly, but that is a mere matter of discipline. When the Snider rifle first came out, a certain General, I forget who, used to make his men take off the nipple guard and put it on again several times between each round, to accustom them not to fire too hurriedly.

A question I leave for others to decide is whether if armed with a

magazine rifle a bayonet would still be necessary. In deciding this point all possible positions in which mounted marksmen might be placed should be considered.

Mounted marksmen might under certain circumstances be separated from their horses, and their ammunition being expended they might be attacked by cavalry or infantry; and there are other positions in which they might find themselves when a bayonet would be necessary.

To show that I am not a mere theorist in the matter of shooting, in stating that carbines are perfectly effective up to 500 or even 600 yards though they are insufficiently accurate at greater distances, I may mention that a squadron team of four of the 14th Hussars, when competing for the Loyd-Lindsay Prize in India, a few years ago, made a score of 129 out of 160 points, which is, I believe, the highest score ever made in that competition. Every shot was on the targets, no miss having been made at either distance.

Three-quarters of a mile was galloped over, two flights of hurdles were jumped, and forty shots fired, each man having fired five at 300 yards and five at 400 yards; and the team was drawn up at the starting post, having completed everything in nine minutes.

On the last target, that at 400 yards, ten out of the twenty shots on it were bulls-eyes.

The state of perfection the team attained was due to the fact that the Officer commanding the regiment encouraged shooting and facilitated the necessary amount of practice.

I can vouch for this account being correct in every detail, as I was one of the four myself, and coached the team.

Carbines are very good at 500 yards and fall off very slightly at 600 yards; I have seen a very good shot (Corporal Robinson, 14th Hussars) make 92, and another man make 91 of a possible 105, in 7 shots at 200, 500, and 600 yards each, 21 shots in all.

Ninety-two was the score made with the Martini rifle that won the Queen's Prize at Wimbledon, under similar conditions a few years ago.

The carbine is not nearly so reliable at greater distances.

Some may think I have proved too much, and rather demonstrated the sufficiency of existing carbines. But we must remember the above are exceptional performances for a carbine. We must strike an average and find a weapon suitable to the generality, and one that shoots better at long distances than a carbine.

Weight affecting Efficiency.—There could be no greater mistake than to arm this force with a carbine instead of a rifle or, in my opinion, to dispense with the bayonet. Someone is sure to suggest something of this kind:—they will perhaps say the rifle is awkward to carry, or too heavy; perhaps it may be even said it looks ugly. The suggestion reminds me of the answer we all remember given by the sportsman to the novice, who remarked that his horse, which happened to be an undeniable hunter, had a very ugly head, "True, sir, but I don't happen to ride on his head."

Lancers carry a lance, sword, and carbine: the total weight of these three far exceeds the weight of a sword, rifle, and bayonet. A rifle and bayonet exceeds a carbine by very few pounds. If it is necessary

to diminish the weight of mounted men, there are more practical ways of doing so than by tampering with their weapons or insisting on the men being very small.

When no other objection can be found, people often fall back on the statement that a proposed article, whatever it may be, "is too heavy," and considering the statement unanswerable, expect their opponent to immediately collapse.

In furnishing a soldier, the first thing to be considered ought to be what weapons are necessary; those weapons being decided on, heavy or light, they should be sacrificed to nothing. The second thing to consider is the required stamp of men, and in case of cavalry the necessary stamp of horse.

Wherever weight is to be saved it is certainly not in the weapon, which is, indeed, the *raison d'être* of the soldier. Better take a man's coat off his back than deprive him of a particular weapon because it is a few ounces heavier than a less valuable substitute.

In a flat race every pound tells, because the horses, who are trained to run for their lives, have to get over a limited distance at the greatest possible speed; but there is none of this kind of thing in cavalry work; and though every unnecessary pound should be dispensed with, the importance of using a good stamp of soldier and perfect weapons should not be sacrificed for the comparatively small matter of lessening the total weight the horse has to carry, and that so slightly as not to benefit the horse materially. Very small men have not sufficient endurance and stamina.

What stamp of men do you generally see in at the death after a hard run? Who are the best polo players? Who are the most successful pig-stickers in India? Four-fifths of them are men from 11 st. to 13 st. 7 lb., or heavier. In theory they ought to be men from 8 st. to 10 st. 7 lb., but such is not the case.

This, perhaps, may be partially misleading, should it not be remembered that many very heavy weights chiefly maintain their position in the field by buying more expensive animals than their lighter brethren; but this does not completely nullify the argument. However, certain articles carried by our cavalry might, I think, be carried otherwise than by the horse, or dispensed with, if necessary to make way for an increase of a few pounds of weight in an improved weapon.

A cavalry soldier parades in marching order with a valise on his saddle containing a complete change of underclothing, gloves, hair brush, comb, &c. I do not remember ever seeing a man use any of these things until the tents were pitched. If it is dry he does not want them, and if it is raining and he is wet through he has work to do in the first place which generally occupies him until the baggage arrives; and secondly, if he has done his work he has no cover under which to undo his valise and change until the tents are pitched. He may go inside and change then if he likes; but if it has been raining heavily he will very likely find the kit in his valise as wet as that on his back. However, dry or wet, why should it not be carried in the same conveyance that brings his tent, &c.? In cases where the

transport runs short he can carry it and other things if necessary, but all this useless dead weight should be avoided whenever possible. Again, what is the use of a man, when on active service, carrying about a brush and comb? Is it not far simpler to remove his hair by running a clipping machine or a pair of scissors over his head, as I have often seen done. It is most comfortable and healthy. An Adonis chary of parting with his love-locks might console himself by the reflection that his hair would only grow the thicker after trying the treatment I recommend during a campaign. He will find it a most successful hair restorer. A cloak, instead of being so generally carried on the saddle, should only be carried in case of wet weather, or the probability of having to bivouac for the night. All the kit it is necessary for a soldier to carry is, a set of shoes for his horse, his horse's food, picketing kit, a dander brush, a horse rubber, his own rations, and an oil rag; everything else should accompany his tent.

Clothing.—I would suggest it might be well to try what I think will be found an improvement in the system of clothing the British soldier. The efficiency of an army depends a great deal more on perfection of dress and accoutrement than can be imagined by superficial observers. It has been gradually dawning on us during the last few years that the uniform of our Army is not sufficiently comfortable; the consequence is that efforts have been made to make it more so, without detracting from its smartness. The results have proved more or less failures. Uniforms are certainly becoming more comfortable, but the smart dress of the British soldier is gradually disappearing; and if we go on much longer at this rate it will be difficult to distinguish a soldier from a policeman. Now this won't do at all. There never was a truer saying than "Fine feathers make fine birds." Do away with gaudy dresses in time of peace, and feats like the charge of Balaclava and other corresponding gallant deeds will only be read and sung of, if not forgotten.

It is hardly necessary to prove the advantage of attractive uniforms. Anyone who has tried to follow up the question must see it. Give a man a uniform he is proud of, and it makes him twice as good a man as he would be without it. Proud of his uniform he becomes proud of himself. He goes on to question himself as to whether he deserves that pride; he then determines to deserve it; his character and sentiment improve; he emerges like a butterfly from a chrysalis; from a heavy-brained, sottish lout, to become a smart, intelligent, dashing soldier, a something nearer deserving the term—a gentleman; a summit of perfection we all endeavour to attain. Now it is almost an impossibility to combine fully a smart soldierly appearance with comfort and utility in any garment. Appearance must be kept up for the sake of the Service, and comfort and utility must be remembered when we are on a campaign.

In most regiments the men are in possession of two tunics. Instead of this I think it would be found better if they were provided with one tunic made very ornamental, to be worn at reviews, on Sundays, and on all occasions when a very smart turn-out is neces-

sary, and one marching-order coat, something loose and comfortable and devoid of ornament, to be worn on marching-order parades, night guards, &c., and whenever appearance need not be considered.

Cavalry should have two distinct dresses. One should be as ornamental and attractive as possible, and fit like a glove, tunic, breeches, and boots, to be worn on all show occasions. The other dress, a loose Norfolk jacket, breeches, gaiters, and ankle boots, should be devoid of ornament; comfort in it should be considered as much as ornament in the other. When going on service the ornamental dress should be put into store, the marching-order dress only being taken. The men should, of course, retain the smart cap and jacket now in use in undress in all cases except when on service.

I will now venture to digress for a few moments, and say something on a matter allied to, but not identical with, the subject of this paper:—I refer to mounted infantry.

When the system of training cavalry as mounted marksmen has been thoroughly worked out, but not till then, I would make a desirable and important improvement in infantry regiments.

It would prove in many ways most advantageous to infantry to have at the disposal of each battalion a small proportion, say one company per regiment, taught to ride; these I would arm with a rifle and a bayonet only.

This training should be carried out in the following manner. There are those who hold that infantry do not require much care in teaching them to ride sufficiently to perform their duties as mounted infantry, and that small and indifferent horses will serve their turn well enough: but this appears to me a half-hearted principle. If men have to be taught to ride it is almost as easy to do it well as ill, and will prove much more satisfactory in the long run. A cavalry dépôt should be formed at Aldershot or some equally central place, the instructors of which should be well versed in the training of mounted marksmen, and thither regiments should send companies to go through a course of instruction. Horses supplied from cavalry regiments should be kept there for their special use. The course should last about six months. During the course the men should ride at least about one hour or one hour and a-half in the morning and one hour in the afternoon. They should not only learn how to ride a horse, but also how to groom and otherwise look after him, how a saddle and bridle should fit, and all similar necessary details. A few should be taught as much farriery as possible in the time, and some should learn how to stuff a saddle, &c.

Too much time should not be wasted in letting them jog round a riding-school, but as soon as they begin to feel at home they should be taken out and hustled over a few fences. Meanwhile they should be thoroughly instructed in the duties of mounted riflemen and outpost duty; as soon as they are sufficiently advanced they should be practised in the following manner, under experienced Officers the first time or so, and afterwards under their own.

I. Information having been received that a small force had encamped the previous night, 10 miles off at an indicated place, the

mounted riflemen are sent out to find them, and if suitable engage them.

II. On another day, a position, say 6 miles off, is mentioned, and the mounted riflemen are sent to attack it. Thence acting as a rear guard they should fight their way back to barracks.

They should on these occasions be taught the principles of advance and rear guard, flankers, &c., so as not to be caught napping.

On other days they should be sent on outpost duty.

On these duties they should be taken across country to a certain extent.

They need not practise ball firing during the course: presumably they are all good shots.

At the completion of the course, the Officers and non-commissioned officers should be required to pass a limited examination. They then should return to their regiments, dismounted as they came. Having returned to their regiments, to enable them to keep up their training they should occasionally be mounted on the necessary number of horses provided for them by a cavalry regiment, should there be one at the same station. Here you see the advantage of the men having been trained properly to ride cavalry horses.

For instance, suppose the 3rd Hussars, 4th and 5th Regiments, are stationed together at Colchester. At 6 A.M., 1st January, the trained companies of the 4th and 5th Regiments will march to the stables of the 3rd Hussars, saddle, bridle, and turn out the horses told off for them; then form up and march off. On the completion of their manœuvres, they return, water, feed, and groom the horses. They then march back to their own barracks. This may be done once a fortnight, if possible, but even an occasional day would prove sufficient to prevent them getting too rusty.

Should a regiment with a trained company of mounted riflemen be where no cavalry are stationed, they must wait for an opportunity. I can almost fancy I can hear one theoretical objection to this system: "The horses are too large for infantry generally, not sufficiently quiet, and the men would take too long to mount."

This is nonsense! If a man is taught, he can ride a big horse, and if he can ride a big horse, he can ride a little one; the men having been trained on cavalry horses can ride them, or cobs, or ponies, or whatever they may come across in a foreign country.

As for such an objection, if we have to wait for every tinker who may choose to play "bob-cherry" with his stirrup when ordered to mount, we shall never get on; he would get his foot in and be off fast enough if a few bullets were whizzing about him.

We must have smart men for this kind of work, not dawdlers. Besides, infantry and cavalry men are much the same size, and can ride the same sized horses, and if they were not, after all it matters little. One way often unnoticed by superficial observers by which the British soldier shows his pluck is, that he will somehow or other generally manage to do whatever is expected of him. If men are told they can do a thing, *they will*. But if they are told they can't, *they won't*.

On service these mounted companies, having been fairly well trained in England, will take a very short time to adapt themselves to whatever animals may be provided for them. They will be found most useful as marksmen in action, as scouts, as mounted orderlies, for outpost duty if necessary, for reconnaissances, and for other purposes. I should say at least three or four companies could be trained in a year at Aldershot in a moderately large establishment, by two companies at a time, six months each two companies. If a greater number are required to be trained, increase the establishment; if more companies still are required, then organize a similar establishment elsewhere.

These men should have slightly better pay, as they will have more work, and be a little more scientific. A good class of men being required, their position should be made attractive and popular, both by dress and pay.

An increase of pay might, perhaps, prove more beneficial to the men if, after being put into one pocket, it were not taken out of the other.

“Ha! what familiar memory in mine brain dost stir,
Rich gifts wax poor when givers prove unkind.”

There will be no difficulty in selecting the necessary number of smart Officers and men for this work, there is abundance of material of this sort in most regiments; of course they must be all skilful shots and intelligent. The Officers should be selected for their knowledge of musketry, horsemanship, and above all keenness. There are many infantry Officers with a very good knowledge of horses and horsemanship, learnt before their entrance into the Army and after. The companies should never be allowed to forget that they are mounted marksmen, pure and simple; they should not be armed with a sword, or taught to fight mounted. It will take them all their time to learn their work as mounted riflemen, and if they do that well they will prove most useful.

This scheme, I believe, is what is required: it is a plain, uncomplicated, simple, inexpensive method of training any required number of mounted infantry, without necessitating their permanent maintenance.

I now return to my original subject.

If one corps of cavalry prove capable of efficiently performing their duties as cavalry without deterioration, and also those of mounted marksmen equally well, what is proved?

Does it not stand to reason that all our cavalry regiments can do the same if equally well instructed? Of course Household Cavalry and regiments armed with a lance must be excepted, but with those exceptions every cavalry regiment in our Service should substitute for their present dismounted service the duties of mounted marksmen.

After all, I propose no such very great change, but simply a re-organization of our dismounted service.

If any falling off in the efficiency of their mounted work is detected under this change, we may be sure there is a screw loose

somewhere in the system employed. The weak point should be immediately sought for and strengthened.

It is acknowledged that cavalry should be trained to fight on foot. I do not propose any great addition to their work, but simply that instead of being trained to fight well when mounted and badly on foot, they should be so trained as to be able to perform both duties well. Why ignore such a valuable part of their duty?

It is because of their inefficiency in this respect that the demand for mounted infantry has arisen.

Captain Lumley, of the 13th Prussian Uhlans, a distinguished Officer of experience, in a very interesting paper on Mounted Infantry, from which I mean presently to quote certain paragraphs, states that mounted infantry should on no account be used as cavalry. I entirely agree with him. But it does not at all follow that cavalry should not on occasion be used as infantry.

What, may I ask, is the meaning of the present dismounted service of cavalry, and why have they carbines?

To enable them to fight on foot.

What are mounted infantry?

Mounted men who can fight on foot.

Why are mounted infantry more efficient for fighting in this manner than our cavalry, who also are trained to fight on foot?

Because they shoot better, because they have a better shooting-iron, because they are more suitably dressed, and because they are more suitably trained.

Is it not evident that if our cavalry are armed, trained, and dressed properly, they can do this work instead of their present dismounted practice?

Captain Lumley, in his paper, recommends that England should raise a large force of mounted infantry. It may be advisable for nations like Russia, with her hordes of Cossacks, to organize large forces of mounted infantry, but the system would never prove satisfactory for England; and I doubt whether it has proved so successful as expected even in Russia.

For England, with her compact but expensive Army, to organize mounted infantry on a large scale, or to carry out more than the limited company training, would not be judicious even were it possible.

But, by simply making a very slight alteration in her cavalry, England can in that branch of her service practically possess 15,000 riflemen.

How it is I know not, but British cavalry seems the last thing people care to meddle with. If they are closely criticized, the cry of *Noli me tangere* is so loudly raised that the critic has to beat a speedy retreat.

The present dismounted service of our cavalry is like a bad tooth that must come out. Pull it out then and have done with it, and no, we will not put in a *false one*, but let a second fill up its place.

This second good sound tooth is the service of mounted marksmen, and a very sharp tooth all those who try it will find it to be.

As an example of the extent to which the feeling that our cavalry

are not to be touched, for good or bad, sometimes goes, I may mention that whatever may be done in practice, though the cavalry carbine exercises have been assimilated for uniformity of drill to the infantry rifle exercises, neither the kneeling nor lying position in firing is recognized in that manual for cavalry.¹

It is even within the memory of man, that it was held as an article of faith that the only legitimate use of the carbine was to be employed as a *pop-gun* when a vedette had to give an alarm. Well, we have improved since those days; but we must not shut our eyes to the fact, that though our present state may be considered good in comparison to the past, there is yet room for great improvement.

Many authorities say that mounted infantry should, on no account, be armed with a sword or taught to consider themselves cavalry; at the same time it is stated that cavalry should always attend them.

During the Crimean War, Europe watched with interest the performance of the Russian Dragoon Corps, numbering 16,000, half of which were cavalry and half mounted infantry; they were trained to act in concert.

This corps had no good opportunity of acting in combination and was not considered a success.

At the termination of the war the mounted infantry were converted to cavalry.

Now, again, the whole of the Dragoon Corps of Russia are armed with the long rifle and drilled as infantry when on foot; but I do not, by any means, quote them as an example, as they are but poor troops, their system and training being imperfect.

Mounted infantry in large numbers attended by cavalry in proportion are too unwieldy a force and will never satisfy expectations.

On the other hand, cavalry trained as mounted marksmen can watch their opportunity and act according to circumstances.

Napoleon, in speaking of mounted riflemen, simply expressed the opinion that "an army of 10,000 men, which could cover on an average 20 miles a day, would conduce as much towards the success of a campaign as one of 20,000 moving only 10 miles a day."

In reconciling this opinion with the fact that he did not use mounted infantry, it may be presumed that he did not consider a corps trained only as mounted infantry sufficiently remunerative to employ it, and that he did not organize his cavalry to absorb these duties, as he was otherwise too much occupied to devote sufficient attention to a subject requiring such great care in detail, perpetual supervision, and one that can only be undertaken in time of peace, starting with the material of first class cavalry.

It may be said, cavalry are so much required for mounted work that they cannot be spared for the work of mounted marksmen. Cavalry are never required to act in more than one way at once: they should be capable of acting either to attack as cavalry, for outpost

¹ See footnote, page 43, "Manual and Firing Exercises for the Martini-Henry Rifle and Carbine," para. VII, Firing Exercise, 1881. (The preceding edition contained instructions for firing kneeling, the direction to "bring the weight of the body on the right heel" being of course omitted.)

duty, or as mounted marksmen, with equal efficiency: and a good cavalry leader will always see at a glance in what manner to use his men with the greatest effect.

Cavalry Officers, as a rule, dislike the idea of using their men as infantry. Men who only understand thoroughly the use of their own branch of the Service are inclined to be bigoted and think it is the best, forgetting that each branch of the Service, as at present constituted, is only capable of utility in its own way. Besides, cavalry Officers have no opportunity of using their men effectively as dismounted men, as their arms, equipment, and training are at present very imperfect for that purpose; and yet no men are more capable, if properly trained, of performing the duties of infantry. The training of cavalry soldiers improves the nerve and brightens up the intelligence in a wonderful degree.

Many cavalry Officers think the present dismounted service of their regiments superfluous, unnecessary, and valueless; and little wonder, for they feel they cannot, with confidence, hold their own against any decent force. But let them find themselves thoroughly efficient as infantry when they are required to act as such, and birth will be given to a very different feeling.

There existed until recently an opinion, stated with confidence and supported by many adherents, that cavalry should be taught to despise the rifle, and that an intimate acquaintance with it would be calculated to make them lose confidence in their own powers; in short, it was thought that to ensure reliance in the sword it was necessary to encourage contempt for the rifle. "Where ignorance is bliss," &c., has occasionally perhaps proved true, but more often it is likely to prove a snare and delusion. If there ever was any merit in this opinion is a question, but whether so or not it is too late to use it now. Since the Franco-Prussian War, when France employed 40,000 cavalry and Prussia 54,000, all European nations, England included, have been making decided strides towards the end that will ere long be attained of combining the duties of mounted marksmen and cavalry. In all armies cavalry are considered imperfect unless they are trained to fight on foot. English cavalry go through an annual course of musketry with a Martini-Henry carbine sighted up to 1,000 yards, and are taught to fight on foot as skirmishers, &c. Their musketry training is continually being increased. Quite recently an order has been issued from the Horse Guards that cavalry Officers are to go through a course of musketry at Hythe; all this tends in one direction.

Taking into consideration the knowledge of musketry that cavalry already possess, it is evident that it will not prove in any way to their disadvantage to substitute for their present training as skirmishers the duties of mounted marksmen.

Mark how little is the alteration required to enable cavalry to perform the duties of mounted marksmen. Strap the sword to the saddle, as has already been advocated so often, supply a rifle instead of a carbine, and with a few slight alterations regarding boots, &c., the only addition necessary is more musketry instruction and a bayonet.

I wish particularly to draw attention to the fact that in consequence of the advance of the breech-loader the value of the cavalry has been generally acknowledged to have deteriorated; this decrease in value can only be counterbalanced by making them absorb the duties of mounted marksmen, instead of perpetuating their present dismounted practice.

In again referring to the erroneous popular idea that a knowledge of musketry deteriorates cavalry, how is it that though cavalry of the present day have a much deeper knowledge of musketry than either cavalry or infantry had thirty years ago, they ride as straight when required as ever they did?

Those cavalry of old who were unarmed with any sort of carbine or rifle did not ride with greater gallantry; and I am sure they did not know their duties so well as our cavalry do now.

I have in this paper tried to show the most effective and most economical manner in which to create mounted marksmen; and I may here assert that when this branch of the Service is used on the Continent, small numbers will be found insufficient; and it is only by the method I propose that England can ever have large numbers. It entails hardly any expense, and practically does away with the objection of recognizing a third branch of the Service, an objection so strong that no European nation will approve of it, though Russia is now making some attempt that way, and England is talking of it. They all are rapidly approaching the end I point out, by teaching their cavalry to perform a great part of these duties.

Some day we shall see no cavalry considered sufficiently valuable who do not fulfil the duties of mounted marksmen. It cannot be a matter of indifference whether England sets the example or not: those who have practised longest will perform best.

To ensure a fair trial it will be necessary to appoint to the trial corps carefully selected Officers.

It may at first be offensive to cavalry to use a rifle and bayonet instead of a carbine, but such feelings as they possess on this subject have already been trampled on by the great increase of musketry practice that has necessarily been of late years required of them, and we must risk raising a little more indignation; this will subside when in future warfare it is found that this branch of the Service is of greater utility than they have ever been.

As we are racing with other nations we should not be satisfied to merely march with the times, but whenever we can, get a step in front of them.

The term "Mounted Infantry" will be soon considered as much a misnomer as that of "Horse Marines" is now.

Our cavalry are good men well mounted. In teaching them to absorb the duties of mounted marksmen, if good results are not obtained with such good tools, *the carpenters will be to blame*. Once the system is thoroughly inculcated, good results should not be merely expected of Commanding Officers, but should be insisted on.

The fact is, the thing has never been tried in a manner to ensure success, and until it is so tried it will never be believed in.

Many systems have been tried: the reason they have all partially failed is that this sound principle has been lost sight of,—that the men employed should be *equally* efficient as cavalry and marksmen, and equipped so as to perform those duties equally well. Neither has use been made of the only material that can be depended on to accomplish the requirement thoroughly, viz., very efficient cavalry.

If bad cavalry are used they will not answer; if they cannot do one kind of work well they certainly cannot increase their work without deteriorating.

I refer to the systems tried by Russia, Germany, and America at different times, to which I have no space to allude fully.

In Russia and Germany the equipment generally used was a rifle, sword-bayonet, and pistol. The men were taught to consider their work on foot of greater importance than their cavalry work.

In America, though they were armed with a rifle, sword, and revolver, the men started without any knowledge of cavalry training, never were good cavalry, and never had good cavalry opposed to them. At the beginning of the war there was not a brigade of cavalry between the two armies, North and South: before the end of it 150,000 were employed. They were the most useful soldiers employed in the war, their performances are well known; but it must be remembered they never had to oppose good cavalry.

There has always been a bias on one side or the other; a perfectly sound system has never been worked out.

In spite of the faults in their previous organization, it is well known how mounted riflemen have turned the scale in many battles. For instance, Peter the Great's brilliant victory at Pultova, and its subsequent results, were owing to the masterly way he made use of this arm. I quote Captain Lumley:—

"The Czar covered his advance with 1,000 dragoons, who, coming upon the enemy, dismounted and opened the engagement, but on the infantry coming up they were ordered to form up in *ordre de bataille* alongside of them, on the flanks. A severe struggle took place, resulting in the defeat of the Swedes, who were closely followed up by Prince Menzchikoff with a large body of dragoons and cavalry, with infantry mounted *en croupe*. Coming up with them on the banks of the Dnieper, which they were unable to cross, he compelled General Lovenhaupt to surrender with 14,000 men."

Such a result could never have been obtained with infantry unaided, no matter how fast they marched.

Another example of what can be done by a combination of the horse and rifle mutually assisting each other, are the operations of General Sheridan, which "materially contributed to the surrender of General Lee's army at Richmond, and to the termination of the American War." Referring to this Captain Lumley quotes:—

"On the 29th of March, 1865, General Sheridan set out with 10,000 mounted men to carry out his great turning movement of the right flank of the Confederate Army. A severely contested fight occurred on the 31st, when he successfully resisted a combined attack of all three arms with his dismounted horsemen, at Five Forks, while,

on the 1st of April, he stormed and carried the enemy's position with three of his brigades. General Meritt, with the reserve brigades, taking up the pursuit, captured 6,000 prisoners, and caused a total loss of 13,000 men to General Lee's army. This battle of Five Forks virtually decided the fate of the war; for General Lee evacuated Richmond, and retreated in the direction of Danville, vigorously pursued by Sheridan's cavalry, who, seeing that the Confederates' force was too great for him to defeat by a direct attack, swept round its flank, crossing Sailor's Creek before it, took up a position across the road on the far side of the stream, and dismounting, disputed General Lee's passage of the stream. Operating in like manner at Lynchburgh, he got the Confederate Army between his and General Grant's forces, and thus brought about the surrender of the whole Confederate Army at Oppomattox Court House on the 9th of April."

Here 10,000 mounted men, armed with a sword, rifle, and revolver, were enabled to perform, by their adaptability to circumstance and mobility, what 40,000 otherwise organized could not have achieved.

Again, in speaking on this subject, Captain Lumley says:—

"In my opinion, the Battle of Mars-la-Tour, if compared with Sheridan's movements after the engagement at Five Forks, speaks greatly in favour of the employment of mounted infantry. Although the object in view was obtained in the former battle, by the noble sacrifice made by the Prussian cavalry, still, although a cavalry Officer, I cannot help admitting that the same result would have been obtained at a very much less expenditure of life and money had mounted infantry been employed."

It is evident in this case that if those cavalry had possessed rifles and had been trained to perform the duties of marksmen, they would have been much more valuable than either cavalry or mounted infantry by themselves, or the latter attended by cavalry. How often on service, when nothing but cavalry are available, is it said, "Oh! if we only had some infantry handy." And how often when infantry only are present is it said, "Oh! if we only had a few cavalry." But it is not only in pitched battles that cavalry would find the enormous advantage of being armed so as to act efficiently on foot. I take for instance one of the many brilliant performances of General Morgan in the American War:—

"Starting from Knoxville on the 4th July, 1864, he reached Medway on the 12th, having marched 300 miles in eight days; such was the extreme mobility of his flying column that the enemy were unable to obtain any correct information of his intentions or whereabouts. The result of this raid I had better describe in his own words: 'I left Knoxville on the 4th July, with about 900 men, and returned to Livingston on the 28th with nearly 1,200, having been absent just twenty-four days, during which time I had travelled over 1,000 miles, captured seventeen towns, destroyed all the Government supplies and arms in them, dispersed 1,500 home guards, and paroled nearly 1,200 regular troops. I lost in killed and wounded about 90 men.'"

Here we see an example of what splendid execution a smart cavalry

brigadier should be able to do with cavalry able to act efficiently on foot when necessary. Nothing but first class cavalry would answer for this work in Continental warfare, as they would always have to be on their guard against good cavalry. They should usually be used solely as cavalry, and only when absolutely necessary, and when good opportunity occurs, should they be called upon to act on foot. When so employed they should be able to act with equal confidence and efficiency, if they are not, better never use them at all than put them in a false position.

It seems that though the solution to this difficulty has been always staring us in the face no nation has the energy to grasp it.

This is not a matter to be shirked by theoretical assertions: there is only one way to test it, and that is by trial. And no superficial trial will do.

Three corps should be organized, great care being taken that the Officers are carefully selected. These corps should be stationed in different parts of the country and constantly inspected.

It will be found that this will produce emulation, and the greatest possible results might be expected. After a long fair trial, it will be within the power of the Officers commanding those corps to answer the all-important question satisfactorily. Can cavalry be so trained as to perform with equal efficiency the duties of cavalry and marksmen?

I trust that I may not be regarded as a bull in a china shop in handling this matter, and that it may not be thought that I thoughtlessly "rush in where angels fear to tread." Some may consider that, with insufficient experience, I suggest too great an increase in work for cavalry; but this is not so.

I am enabled to venture an opinion as to the amount of work men can do, and the most judicious manner to work them, as I have had the advantage of serving five years in the ranks of a regiment, the discipline of which I have not only never seen surpassed, but never seen equalled, the 2nd Life Guards, in which regiment I enlisted at seventeen and a-half, and from which I was promoted to a Sub-Lieutenancy in my present regiment seven and a-half years ago. I have no hesitation in representing that it would prove of the greatest advantage to all Officers if on joining their regiments they were obliged for the first six months, or year, to do a private's work, to groom their horses and clean their arms and accoutrements, in fact almost everything short of associating with the men in their barrack-room.

This might be limited to the time they are learning their drill, &c., with the recruits of their regiments, at which they should be kept at least eight months. It would prove of lasting benefit to them to be subjected to this training. They would thus possess knowledge of the details of a soldier's life that cannot be gained in any other way, and which go far to constitute the difference between an amateur and a professional. Officers passed by the medical board as physically fit for Her Majesty's Service should not find the work injurious in any degree, but entirely the reverse.

Though to me a novelty the only conspicuous alteration that I observed in myself when going through my training as a cavalry

recruit was that my muscle and appetite alike increased perceptibly, the latter sometimes to an inconvenient extent. In a certain cavalry regiment young Officers are made to go to their regimental farrier's shop and carefully learn the rudiments of a farrier's work. Practical knowledge of this kind is never thrown away. It cannot be stated that this is no work for gentlemen; they must be poor gentlemen, and would prove poor Officers, who thought such work beneath them when told it is for the benefit of the Service.

The author of "German Home Life" quotes the speech of a German General which contains a sentence that clearly points out the secret that ensures success in all undertakings of the description I propose in this paper. The sentence to which I refer runs as follows:—"Great results can only be expected when every demand of duty and honour shall first have been complied with, when, under all circumstances, the strictest discipline, and the most untiring industry, an industry which undervalues nothing, and thinks nothing trifling or insignificant, shall form the firm foundation without which the superstructure can avail us nothing."

Nothing is good unless it is perfect. Half measures never answer. Mounted infantry may be thought sufficiently effective when we have to contend with unscientific masses of Afghans, Zulus, Boers, and Egyptians, such as have been our opponents of late years; but when we are let in for the European war that will probably come sooner or later, cavalry equipped as I have tried to describe will, I think, be found more practical, and must be, I believe, *the force of the future*. The sooner we make them *the force of the present* the better.

I think this is the answer to the mounted infantry riddle which has been found difficult to solve.

In concluding these few suggestions, I would venture to express the hope that England, having seen in her last few little wars the use of mounted infantry, will not wait until other European nations have perfected the mounted branches of their service, and then by her own loss perhaps learn to appreciate their real value. No nation produces finer riders or better shots; combine these two in our cavalry, and you will shortly have a *corps d'élite*, unrivalled in smartness and efficiency, of which any country might well be proud, and of which all countries will surely be envious.

I thank you, ladies and gentlemen, for the kind attention with which you have listened to me.

The CHAIRMAN: Lieutenant Hamilton has given us, I think you will acknowledge, a most interesting lecture, though probably the views that he has expressed are different from those which would have been brought forward by Lieutenant Piggott. It is very advantageous that both sides of this question should be heard. I am sure many Officers present will not quite agree with Lieutenant Hamilton in all that he has said, and if they will be kind enough to express their opinions we shall be very glad to hear them.

Colonel GONNE, late 17th Lancers: There are many Officers present more fitted and more able to speak on this subject, but I will offer a few remarks just to raise a discussion. From what I have understood of the very able and interesting paper to which we have listened, the writer is in favour of meddling with our cavalry as to its equipment. As a cavalry Officer I object to that, because we own only a handful of

cavalry, which has done its duty fairly, though perhaps it might be improved. The writer also proposes to change the weapons of the different descriptions of cavalry except the Lancers and the Household troops. Now I consider that the Lancers and the Household troops ought to be the first "meddled with," because they are less useful for what I call general purposes. The Lancer is handicapped with three weapons—the carbine, the lance, and the sword, and it almost renders him inefficient. The Household troops are very good for special purposes. There are few of them, and they have been very usefully employed lately; but it is a question whether troops of that description could have stood a long campaign. If any cavalry requires alteration it is first the Lancer and then the Cuirassier. However, we have only got a small force of cavalry, and I object *in toto* to the cavalry being meddled with. Let us, therefore, rather turn to the question of how we are to supplement them. The greatest mistake would be to allow the infantry to suppose that they can be expected or intended to work as cavalry. I should give them, on emergency, a horse, which never could be called a charger. I should give them a horse of such a height that it would not be difficult to mount rapidly. I should certainly not give them a sword, and if the mounted infantryman had a sword the last place to which I would fasten it would be the saddle. The Russians have lately added fifty per cent. to their cavalry strength—they have turned the bulk of their cavalry into dragoons. They intend to have a strength of over 20,000 with which to make a raid. Dragoons will be armed, as the writer stated, with a rifle, not inferior to that of the infantry, and a bayonet. These men, when they parade before the Czar, dismount before they come to the saluting post, and march past as infantry. They are trained as infantry, and are going to be equipped as infantry, but they will not forget that it is necessary to have "overalls," which admit of the leg being thrown over the saddle—that is, not too tight. Our soldiers would probably suffer greatly unless we changed the equipment of the infantryman to make him able to ride. I have seen the Russian dragoons, and I have had the honour to report that they are about as useless a force as exists in that fine army. I have been also with infantry, during a sham fight between Russian dragoons and infantry, and the infantry Officers have turned to me and remarked, "I think, on service, that we should be able to get some horses for our men to ride"—meaning that the dragoons were never able to protect their horses, which were led by a few mounted men. If there is any kind of reverse, the horses fall a victim to the more skilled manœuvre of infantry. I do not think I need take up any more time. I sum up my remarks with the expression of hope that our small force of cavalry will be left as it is, and that in forming mounted infantry we shall use stuff which is proved good for the purpose. Let us train the infantryman to take care of the horse in time of peace, and to be able to ride him in time of war; and let us improve, more than anything, his powers of shooting, so as to make him a good marksman. Then, I think, we shall find that the fifty mounted infantry—I do not think there were more—who were so usefully employed in the Egyptian campaign, will have set a good example to a larger force, destined, perhaps, to perform great feats of arms in our campaigns of the future.

Colonel MIDDLETON: I am one of those many infantry Officers alluded to by Sir A. Herbert, who object to, or rather disagree a great deal with, what the lecturer has told us, and I feel rather inclined to begin by demurring to his assuming such superiority of intellect for the cavalry soldier over the infantry soldier. He certainly has arranged a very nice little sliding scale of intelligence, based upon the lace of his coat; but that would place, I am afraid, the Royal Engineers rather low in the scale, and the cavalry soldier very high indeed. I do not also agree with the idea that the infantry Officer is not equally qualified, if selected to carry out the duties connected with mounted riflemen, as the cavalry Officer. What the lecturer has been really advocating is the re-introduction of the old dragoons, a force which was tried many years ago, but which turned out to be excessively bad infantry, and very much worse cavalry. It was found whenever they were working that they had an irresistible inclination to work backwards towards their horses, which they were never happy until they had mounted, and then they generally got out of the way. The result was that they were gradually abolished. What I take to be the real want of the day is mounted infantry, and there I agree with the lecturer that the term "mounted" is rather a misnomer. I do not know whether it will ever be

quite as obsolete a term as a "horse marine," but it gives a wrong impression of the duties that are required from mounted riflemen. I do not exactly know what term should be used. The word "flying" was once used with regard to artillery; very light artillery was called "flying artillery"; but whatever they are called, they should be selected from infantry pure and simple. Not the slightest change should be made in their uniform; there is no necessity for it. The mounted infantryman should be simply taken off the parade ground, and put on to a cob, or a horse; not a button of his uniform should be changed, no lines should be given him to hold on his cap;—that is a peculiarity I have remarked, that whenever infantry soldiers are put on horses, the first things they want are cap-lines to hold on their head-dress, and then they want spurs, &c. The infantry soldier should be taken off the ground, as it were, and put on his animal, and he must be made to understand that he is not a cavalry soldier at all. The simplest way of making mounted infantry would be for every infantry regiment to have so many horses in peace time, and that the men should be selected as being picked shots, and if possible as knowing something about horses, and not simply for their smartness. I object to that word "smart," because you find sometimes an awkward-looking fellow who is a good shot and can ride, and I should select that man in preference to a much smarter-looking man of perhaps less intelligence, and who is not a good shot. These men should be taught by their own Officers. I would not allow a cavalry Officer to have anything to do with mounted infantry. There are lots of Officers in every infantry regiment who are perfectly competent to teach men how to ride. I do not want the infantryman to ride as the cavalryman does; I want him to ride decently, and to be able to go at any pace required, and that he shall fully understand that the animal he bestrides is simply a mode of locomotion,—that a bicycle or tricycle would be a much better one, only that it would not go over the ground which he might be wanted to travel over. It cannot be too much impressed upon his mind that he has simply a horse to convey him from one spot to another. The fact is, we have been using our improvised mounted infantry in our little wars as cavalry, to supplement our usual deficiency in that arm; and under the command, generally, of infantry Officers, they seem, I think, to have done even that work remarkably well. The lecturer, in the early part of his paper, referred to a question that would have to be put as to whether it was possible for cavalry to perform their own duty as they do now, and to substitute for (what he dislikes very much) the dismounted drill of the present, the duties of mounted riflemen, and he proposed certain experiments to ascertain this. I do not think myself that any experiment is necessary; and I think that when we consider the extra duties that will be demanded in future wars, and that have been demanded from cavalry, those duties being clear and quite distinct from those of mounted infantry, there is no doubt that they will require the greatest intelligence on the part of the cavalry, and I think most cavalry Officers will agree with me that the cavalry will have quite enough to do to accomplish that work alone (without calling upon them to perform other duties unsuited to them). If they do that perfectly and intelligently, I think it will be as much as any arm can be called upon to do, especially when we consider the fewness in number of our cavalry, and we never shall have a very large force of cavalry whatever happens. What we want is simply to be able to move a certain number of infantry rapidly from spot to spot. The want of this mobility is constantly felt on service. Even the young, untried Officers who have attended war-games must have remarked how the unfortunate slowness of the movements of infantry upsets the arrangements of the Officers who are conducting the war-game. I should say that every regiment should have at least thirty or forty horses in peace time; that a certain number of the best shots and most intelligent men should be selected and taught to ride those horses. Riding and stable management will be quite sufficiently taught by Officers who would always be found in every regiment. There should not be a button altered in the man's dress; he could ride perfectly well as he is. There is nothing better for riding in than gaiters, and he should be constantly drilled on foot just as much as the other men. Though I would form a company of selected men as mounted infantry, there is no reason why nearly the whole regiment should not gradually be instructed in riding in this rough way, so as to be able at once to fill up any casualties. I would have no swords or spurs, or anything of the sort. If the man

wants to make his horse go, let him take a stick and make him go. He wants to get to a certain spot, and when he gets to that spot he has to get off his animal at once. If this plan were carried out, every brigade on service would have 300 mounted men, and the divisional commander would find himself in possession of a very good force of not less than 700 men, who would be available and might be massed as in the old days, when they used to mass the flank companies. In this way the divisional commander would mass his 700 men, and he would have very little difficulty in finding a Commander, Majors, and Adjutant for them. There is one thing that has, I think, been overlooked, and that is, that the saddles should be made so that the man may take up another man *en croupe*. The lecturer mentioned one case in which a large force of men were sent forward by being taken *en croupe*. If some arrangement were made in the construction of the saddles, then on a pinch these 700 men could take each a man behind him for a short distance, and so the force of 1,400 men could be sent forward to seize a certain point in advance. Such a movement could be carried out with rapidity and with perfect ease. There would be very little trouble in holding the horses, because there would be few men required. The horses would not be very high-spirited horses, and I daresay they would stand quietly, almost by themselves. There is no doubt that being able to take a man easily *en croupe* would be a great advantage. I saw one remarkable instance of this myself during the Mutiny. I was then with Sir Henry Havelock, who was commanding a party of cavalry and some of the 10th Infantry. We were sent out to stop some Sepoys who were crossing the plain with elephants. The cavalry was not very good; it was improvised cavalry, and it did its best. We galloped on ahead, but found we could make little or no impression on the Sepoys: they formed square and killed a number of our men. We went through a part of them, but the troop Officer was badly wounded, and we had to halt. We then galloped back and met the 10th Infantry, who were coming on, and each took a man up behind him, Sir Henry Havelock and myself included, and of course, as you may fancy, though it was a short ride it was rather an unpleasant one, especially for the infantry. I remember well that I had the breath squeezed out of my body by a big corporal who held on like grim death, gripping me like a vice. The end of it was we rode up, turned round, dismounted the infantry, gave a very good account of the Sepoys, and captured the whole of the elephants.

VISCOUNT MELGUND: I have seen something of mounted infantry, both at home and abroad, and I hope you will allow me to say a few words. I listened with great interest to what the lecturer said as to the absolute necessity of improving the shooting of our cavalry. No doubt they will be all the better for it, and, armed with a better weapon, it will then rest with their own Officers as to how much they will be employed for dismounted service. I do not think a corps of picked marksmen from cavalry regiments would in any way take the place of a mounted infantry corps. Mounted infantry I look upon purely and simply as *bonâ fide* infantry, and nothing else; and their horses simply should be a means of conveying them from one point to another in the theatre of war more quickly than they could go on their legs: that is the only reason that they are mounted at all. Part of the lecture points to the assumption that it would be a good thing to start a mounted infantry corps in time of peace. The British public, seeing the success of mounted infantry in Egypt, assumes that we ought at once to start a mounted infantry corps at home. I am thoroughly opposed to that. I think the result would be simply this—that you would raise a second-rate cavalry corps. Directly the infantry soldier gets on his horse his tendency is to forget he is an infantry soldier, and it is the same with the Officers. You want to keep them as purely *bonâ fide* infantry and nothing else, and I should be very sorry to see an attempt made to establish a mounted infantry corps at home. I think the success of the mounted infantry that we had in South Africa and in Egypt was chiefly due to the rough and ready manner in which those corps were started to meet the emergency of the moment. I am quite ready to say this, that if any corps had been thoroughly equipped in England, mounted on English ponies, and sent out with no end of paraphernalia, I would back the mounted infantry we had in Egypt to beat them out of sight in their performances. I am quite certain that a rough and ready corps mounted on the ponies of the country would always beat any corps we might send out with a large establishment of home-

bred animals. As to Officers, I must very much differ with the lecturer about the proper Officers for mounted infantry. Certainly the infantry Officer is the one to have, and the infantry Officer who has been accustomed to horses. There are plenty of them who are good riders, and understand stable management, and are fond of horses; they are the sort of fellows to have. If you employ cavalry Officers you only increase the danger of turning your mounted infantry into a cavalry corps. One thing that we found very useful in Egypt was this: we applied for a good non-commissioned officer from a cavalry regiment to assist us in stable management, and we found that he was very useful; but as regards the Officers in a mounted infantry corps I should stick as much as possible to infantry Officers. The subject of equipment is rather too long to go into now, but it seems to be generally assumed that mounted infantry should be supplied with a bucket for carrying the rifle. This is very doubtful indeed. Certainly the Namaqua bucket is a very good way of carrying the rifle, but it is very difficult to stop the men from dismounting and leaving their rifles in their buckets; besides, you may be taken by surprise, and there are your rifles in the buckets instead of in the men's hands. In Afghanistan a good number of carbines were lost from the horses falling on the carbines while in the buckets, and the men could not get them out. For mounted infantry the best place for the rifle is in the man's hand. In Egypt the men always had them in their hands; a few of the men who had been in South Africa had the means of slinging their rifles, but they never did it. I do not think that our experience in our late campaigns points to the necessity of raising a mounted infantry corps, or a corps of mounted marksmen, in time of peace.

General Sir GEORGE WILLIS, K.C.B.: I do not propose to take up much time, but I think those who have criticized the paper have been a little hard upon the lecturer. I think we ought to thank him for having brought the subject before us. I believe there is no disputing the value of mounted infantry, but they must be infantry,—there must be no confusion about it; they must be mounted infantry, who simply require horses as a means of locomotion that they may suddenly take up a position and hold it in advance of the troops and infantry. The cavalry have enough to do in their own particular line, and I hope there will be no half-measures, such as having half mounted infantry and half cavalry. As far as equipment goes the soldier simply requires to have gaiters and to carry a rifle in his hand, with the alternative of slinging it over his shoulder to rest occasionally, but it would not form part of the horse attachment in any way. Neither do I see that the mounted infantryman requires a sword; the weight on the horse would be much better taken up by carrying the reserve of ammunition which they ought to have. During the Egyptian war there was difficulty in keeping the mounted infantry supplied with ammunition when they were away at a distance; therefore, whatever weight can be saved from equipment I would give them in the shape of a reserve of ammunition, to be carried on the horse. I think if you give him a sword at all it should be simply a sword-bayonet, because that might be useful in clearing obstacles sometimes and making his way occasionally; but I think there should be no mistake whatever that he should be purely and simply an infantry soldier, armed with a rifle and mounted on horseback.

Captain Sir JAMES SETON, Bart.: I think the balance of opinion seems to be, with all due deference to the lecturer, that what is wanted is mounted infantry rather than that dismounted cavalry should do the duty of infantry. It is a curious thing that we have in the service a portion of our infantry differently clothed though armed the same as the rest of the line generally. Formerly, there were the old 60th Rifles and the Rifle Brigade, and to these have been added the Scotch and Irish Rifles, making in all twelve battalions. The 60th and the Rifle Brigade had their *raison d'être* in the Peninsular War. They were the only infantry trained for effective skirmishing besides the light companies of regiments. They used to do the light work of the army, and occasionally, from necessity, companies were combined into light battalions, as has been pointed out to us. Another point in connection with this subject is that the organization of the British division contemplates there being an additional battalion, sometimes called the rifle battalion, which remains outside of the brigade organization. My suggestion would be, as I believe the authorities look with favour on suggestions made in this theatre,

that the battalions of Rifles should gradually be experimentalized on, with a view of forming them into a permanent order of mounted infantry, and, as has been suggested, great care should be taken to prevent their degenerating into an inferior sort of cavalry. That would suit the financial views of the Government, inasmuch as there would be no necessity to horse the whole of them. If enough horses were provided to allow one company to practise at a time, and the foreign service roster allowed six battalions, there would be no greater increase to the Estimates than 600 horses on the home establishment. A certain number of battalions would be in India, and care should be taken that these should be quartered near the frontier, where there would be more likelihood of their getting practice in large assemblies of troops; and in the constant little frontier wars that are breaking out the military authorities would get experience in the use of that arm. I will not say a word about details, because I have not had the same experience myself as previous speakers, but I would just throw this out as a suggestion.

NOTE.—When I rose I had it in my mind to say that the men should be trained also to break young horses, so that, on our having to send an expedition abroad, the mounted infantry might be horsed on the theatre of war, and thereby sea transport be saved. I had also meant to express the hope that the remarks made by the lecturer as to his early career in the service might go forth as an encouragement to young men of good social position, who have strong military instincts, but find it hard to get through competitive examinations.

Lieutenant HAMILTON, in reply: We have been fortunate in hearing good specimens of the opinions held, to a great extent, by cavalry and infantry against the measures I propose. Colonel Gonne has represented the disinclination held by cavalry to be used on foot; Colonel Middleton and others have represented the disinclination of infantry to part with or even share with cavalry their *bonne bouche*. Colonel Gonne seems to think I wish to change cavalry to infantry. That is not so. I think they should do their cavalry work as efficiently as at present, simply improving their dismounted service. Colonel Gonne also does not approve of the lance. It is well known that many hold that the lance is the queen of weapons; in several cases of cavalry charging cavalry, during the Franco-Prussian War, wherever they met the sword invariably went down before the lance. With all due deference to him, neither can I agree that the Household Cavalry should be interfered with. A sufficient reason is simply that they are *Her Majesty's Body Guards*, and being the finest in the world should be left as such. As to their not being so useful as other cavalry, it is a curious though undeniable fact that, whenever they happen to be proved on service, to say the least of them, they are not found wanting. As I have previously stated I quite agree that mounted infantry should never be used as cavalry, and also, as I have said before, that I do not quote the Russian dragoons as an example for us, in any improvement we may make in our cavalry. I cannot think, with Lord Melgund, that the rifle should be carried by the mounted infantry soldier in his hand, dispensing with both bucket and sling; on many occasions these are almost indispensable; in cases of successive long marches and of a forced march it would be found most wearisome and unsatisfactory. It will be found that most of the objections made to the improving the dismounted service of our cavalry as I propose have been already dealt with in what I have previously said, so I will not occupy your time by further alluding to them. I wish to read a few remarks which have been sent to me—quotations from the *Times* and the *Saturday Review*. Mr. E. Maxwell Grant, in a letter to the *Times*, sums up his argument in favour of the system proposed by me thus:—"The speediest, cheapest, and best plan for providing the mounted infantry of the future will be to change armament and drill of the existing cavalry regiments into a homogeneous mounted force, which will combine all the useful features of the old cavalry organization with the new duties of the force universally admitted to be necessary for the armies of the present and future." The *Saturday Review* says:—"The equipment of cavalry will probably have to be modified in conformity with the requirements of modern war. The use of the carbine increases, while that of the sword diminishes. At present, as everybody knows, the trooper wears the sword while the horse carries the carbine in a leather case attached to the saddle. The result is, that if suddenly dismounted, the man retains the sword which is useless, while the horse

goes off with the carbine which is useful. Before long this will have to be reversed, on service at any rate. Whether 'the bold dragoon, with his carbine, saddle, and bridle,' will find as much favour with the fair sex as his predecessors who carried 'a long sword,' is a point which the rapid march of military improvement forbids us to discuss." I am sorry no one has said anything as to whether it would be advisable for cavalry to use the bayonet for their dismounted service; but I wish to add one reason why they should. Without quoting the many circumstances under which a bayonet is necessary to soldiers armed with a rifle fighting on foot, I would keep the bayonet for the fact that, though it may justly be said that the number of men killed with it, in comparison with the casualties otherwise caused, is small, its moral effect is incalculable. Men fighting on foot, armed with a rifle only, doubly invite the attack of an enemy. They at the same time find themselves deprived of a weapon which naturally inspires men with confidence: thus the enemy are emboldened while their *vis-à-vis* are disheartened. The situation is enough to make the boldest cavalry look over their shoulder for their horses. This is the very thing that we want to prevent. The reason cavalry do not often appear to advantage when fighting on foot is because they are encouraged to consider themselves dismounted cavalry; they should be taught complete independence of their horses when on foot. They should be taught when mounted to trust to their sword, to remember only the rôle of "the Dashing Hussar." Once on foot they should leave their sword with their horse, and grasp with confidence the arm *par excellence* of the foot soldier—the rifle and the bayonet, breech-loader or muzzle-loader, magazine rifle or smooth-bore; a soldier, cavalry or infantry, fighting on foot, should always see a glistening piece of steel at the end of his shooting-iron, and be taught how to use it when opportunity offers. As one of the objects of the meeting is discussion, I should be very glad if some Officers would give us their views on that subject.

Colonel MIDDLETON: As far as the bayonet is concerned, there can be very little doubt, if cavalry are to be armed with the rifle and fight on foot, they should also have the bayonet,—that, I think, there can be very little doubt about.

Colonel MALCOLM GREEN, C.B.: I should like to say one or two words on that subject. The awkward time for a cavalryman is after a charge has taken place against footmen, and the latter, though broken up as a body, do not happen to run away; the trooper then finds it difficult, with his sword only, to prevent himself and horse from being mobbed by half-a-dozen men armed probably with sword and shield (in the East). He cannot, under these circumstances, use a long rifle from horseback to keep the fellows off, but he can easily manage and do considerable execution with a short breech-loading carbine. I am therefore an advocate for keeping the latter weapon for cavalry.

The CHAIRMAN: In asking you to thank the lecturer, I will make a few remarks. As an official, you will understand that I must consider the financial aspect. The lecturer proposes to establish three corps, taken from the cavalry, of 600 men each, 1,800 men in all—a force equal to four of our cavalry regiments on the peace establishment; 1,800 picked men, taken from the cavalry regiments, would destroy the efficiency of far more than ten regiments. What will the Officers of the cavalry regiments say to such an arrangement, taking at least a squadron of picked men from each regiment? Therefore I do not think such a plan could possibly be adopted. As for the Government authorizing the raising of three more strong cavalry regiments, any one who knows the economical view of a Government, whether Conservative or Liberal, will be perfectly sure that scheme would never be carried. I think the lecturer is quite right in upholding his branch of the Service—the cavalry. There is no doubt a great deal more may be done by cavalry Officers instructing their men in dismounted duties. I have, however, seen cavalry regiments myself, when in command, which drilled remarkably well dismounted, and did everything our lecturer wishes them to do. They certainly did not kneel to fire, of which he complains; the paragraph to which he alluded was inserted in the Regulations because the cavalry wore spurs, and it is very awkward to kneel, resting the body on a heel which has a long spur in it. It is not intended the cavalry should not when firing take the same aim as the infantry, but the cavalry soldier wears spurs which he cannot take off when he dismounts, and therefore

some alteration in the position was required. It would be invidious to mention regiments, but one regiment that I saw drilled and skirmished excellently on foot. They did everything an infantry soldier could be called upon to do, and certainly as much as cavalry can be required to do dismounted. I entirely agree with Lord Melgund in what he said—that we do not want what we may call bastard cavalry, fellows who cock their hats on one side and strut about, neither real cavalry nor infantry; though I do not agree with Colonel Middleton that you should take the infantryman from the ranks, and put him on his horse at once.

Colonel MIDDLETON: I say he should be taught to ride.

The CHAIRMAN: I mean to say in his infantry clothes; for I should like to know what his feelings would be if, without a pair of drawers, he was taken and made to ride for a long day in a pair of infantry trousers and highlows. He would feel very sore and uncomfortable, I imagine. The mounted man must have breeches or something of that sort; he must have a dress in which he can ride. I do not think a man will put his spurs in his wallet when he dismounts, as some one has suggested; if he has spurs, he must dismount and skirmish with them. I know the American army pretty well. The American cavalry, so called, were nothing but mounted infantry extemporized. They were mounted troops: they rode—not very well. Americans are not like Englishmen, who are always accustomed to riding: these men had been drilled but a short time, and yet they were able to move in large masses; they fought as often on foot as mounted. We must have a nucleus of mounted infantry in England, if we wish to have them ready for war. I mean that we must have a certain number of men who are trained to ride, and they must know some little about stable management. The greater part of the mounted infantry in Egypt had a short training at Alexandria before Lord Melgund joined them. When they were at Alexandria they worked hard and learned something: the men who knew a little about horses were selected. What has been advocated by the authorities is to have a few horses, or ponies, or mules—anything that can carry a soldier,—at Aldershot, and at the Curragh, in order that the men can be taught to ride—taught just to move more sharply from one place to another, dismount and fire, and leave their horses in charge of a very few men. That, I believe, is all that is required, and that is all we are trying to get at the present time. I do not think the principle our lecturer advocated, of borrowing horses from the cavalry regiments, would at all suit the cavalry Colonels—to see an infantry regiment march into their stables in the morning, take possession of their horses, knock them about all day, and bring them back saying, “Now, gentlemen, there are your horses.” Imagine the Colonel’s feelings! I am afraid it would not answer. I think, however, we ought to be very grateful to our lecturer for having brought this subject before the public. He is quite right to uphold his branch of the Service, and to try and make them as perfect as he possibly can. I beg on your behalf to tender him our very best thanks for his very interesting paper.

Friday, March 2, 1883.

LIEUTENANT-GENERAL SIR ARTHUR J. HERBERT, K.C.B.,
QUARTERMASTER-GENERAL, in the Chair.

SUGGESTIONS ON THE TRANSPORT OF THE FUTURE.

By Lieutenant-Colonel C. E. WEBBER, C.B., R.E.

IN attempting to put on paper the few remarks I shall offer to-day, I was already aware that the military literature on the subject of Transport is extensive in proportion to its importance; but when it became necessary to examine the writings which, in the past, had been laid before the members of the Institution,¹ their extent was realized for the first time, and the task entailed by that examination proved much heavier than might be anticipated. Increased, when it is understood, that in spite of the compilations of one or two very able members, there exists a certain amount of information which has not yet come within easy reach.

The difficulty in subjecting such redundant material to any complete analysis lies chiefly in the existence of—

(a.) The endless narrative of the Transport operations in past wars, and the consequent variety of the recorded experiences.

(b.) The wide difference in the impressions received by the various writers, each drawn from the practical experience reported in those narratives, under various conditions.

(c.) The divergence in the conclusions drawn, by many in high authority, from their own experience and that of others.

I do not pretend to steer my audience over such a sea of conflicting statement and opinion, but only to refer here and there to the work of my predecessors in the subject. Vast trouble has been taken by them to bring together and compile valuable information and facts.

¹ Name of Author.	Volume.	Number.
Wingfield, F.	13	55
Beazley, G. G., Captain.....	13	56
Collen, E. H. H., Lieutenant	16	68
Parsons, Clifford, Lieutenant-Colonel..	23	102
Geddes, W. L., Captain	24	105
Dean-Pitt, D.C., Lieutenant	24	106
Shaw, Wilkinson, Lieutenant-Colonel..	24	106
Heyland, A. B., Major	24	107
Salis-Schwabe, G., Lieutenant-Colonel.	24	108
Shervington, C. R., Colonel	25	109
Hildyard, N. J. T., Lieutenant-Colonel.	26	118

It would be absurd to claim originality in speaking on a branch of the military art which, the more it is followed up, the more evidence appears of its having been thoroughly "thrashed out" by the industry of others.

It seems to me, that, all there is left to be done, is to enlist the judicial mind of my hearers in the consideration of a few leading features of the subject, and to suggest conclusions which may form fit matter for discussion.

I would venture to suggest that if any discussion does arise, the speakers may confine their remarks to those portions of the subject which seem most to require settlement, in such a way, as to give all the assistance possible to those who have finally to decide for the future.

The study of what has been done in the countries from which we are ready to learn, brings out more plainly than ever that here we have the prejudice of official routine and vested interest to overcome by weaker means than they possess. In this condition I do not include India.

Every writer complains that we have not availed ourselves of our frequent experiences. Lieutenant-Colonel Furse leaves it very clear to his reader's mind that, in spite of Committees and repeated experiences, "no real steps are taken in peace to remedy the faults and shortcomings which have occurred in war." Perhaps they overlook that the frequency and variety of these experiences may be the very causes for hesitation.

There are some points which must be ever present in our minds if any good is to arise out of a discussion of this sort. One is, we must subject every recommendation to the test of cost. Every War Minister must reject any scheme which materially increases the Estimates. At the same time what the country wants is finality, and we believe it will stand a certain outlay, if that can be secured.

How is finality to be secured? Did the establishment of the French system of *Intendance* secure it in that country? Did the Control system give us an abiding organization of Army Transport? Has the present Supply and Transport Department satisfied everyone? Did the two most efficient transport systems that modern times have witnessed, viz., those of the Federal Army in the American War of Secession, and of the Germans in France, spring out of analogous institutions or procedure? Does not the question present itself to some minds here at this meeting as follows? Does the experience of our present system show that we have any secure and lasting basis to build upon, except for the energy, intelligence, and devotion, of the individuals whom our late wars have brought to the front?

And, further, can it be said that the *matériel* of our regular Transport is suited to the wants of an army operating beyond our own shores; more particularly when such a question is put, after drawing attention to the experience of wars during which we have used every kind of vehicle except those made at Woolwich?

I cannot too early recall to my hearers the description of our present Transport Branch given here by Lieutenant-Colonel Clifford Parsons

in June, 1879. I will just remind them that he tells us the 16 companies on the peace establishment are intended to be expanded into 32 for war. Their strength, which varies between 182 and 230 of all ranks, working 83 to 127 carriages each, or, at an average of 206 individuals and 105 carriages per company, give an available total in war of 3,360 carriages, worked by 6,592 of all ranks.

I will ask any Commissariat Officer here to-day to be kind enough to tell us presently: how many of the sixteen peace companies took the field with the late Expedition to Egypt; with what strength in rank and file; what number of carriages the Transport sections of those companies were capable of working; how many Transport men were, at home or abroad, available to reinforce them; and, lastly, how the Department proposes, at least on paper, to effect the expansion described by Lieutenant-Colonel Clifford Parsons.

While appearing to challenge the efficiency of what we have, it is but fair to give its friends the opportunity of stating all the advantages of which it can boast.

I will now ask my hearers to venture with me into the arena where the differences between the contending parties have been put to the test; and, where the advocates between supply or subsistence, and transport, being under one control, and its opponents, have fought out their opinions.

If I go back to the account of Lord Strathnairn's Committee, I will do so now to an attached Report,¹ on the subject of Transport, signed by Lord Airey, Mr. Godley, Commissary-General Smith, General McMurdo, and Lieutenant-Colonel Woodhouse. In this most important document is found no hesitation in reporting "that the balance of advantages, as well as of authorities, is in favour of a Department of Transport, organized on strictly military principles, placed directly under military authority and discipline, both in war and peace." They add, "not to be amalgamated with the existing organization of the Commissariat Service, so as to place the Commissary-General at the head of it, or to make him responsible for its efficiency," and that "although the Commissariat requires a very large proportion of the Transport of the Army² in war time . . . there is nothing in the special duties of the Commissariat to give it any peculiar claim or qualification for the organization and management of a corps of military drivers."

Only two years ago a lecturer in this theatre, Lieutenant-Colonel Shervington, wound up a *résumé* of the result of the work of Lord Strathnairn's Committee, by saying—"Thus had army transport become subservient to other interests than those which had been deemed essential to secure its efficiency." This may fully account for the oblivion into which the document, the signatories of which I have detailed, has fallen.

Those who have studied the general report and evidence of that

¹ Appendix XV, E, "Report on the Provision and Management of Transport of an Army in the Field."

² A proportion very much reduced when forage is left out of the calculation.

Committee, and who understand the working of our public Departments, cannot differ widely from Lieutenant-Colonel Shervington in his conclusions that the literal effect of the measures taken to carry out its recommendations, was *very* different from the views expressed on that part of it which refers to Transport.

The great measure was the establishment of the Control Department: under which the Committee recommended the transport should be placed. The proviso that it should be of a military character, under military subordination, produced no change, because the Control simply meant, previously existing organizations under a new name. No fundamental change was made, and to all intents and purposes the Army Transport service of to-day differs in very few respects from the much-abused Military Train, except that it is what some people delight to call less military.

The Army Service Transport, which went to Natal in 1879, was only less military than its predecessor, in that, exchange, purchase, and a few so-called cavalry characteristics, had disappeared.

The *real* Transport of the Army in that country was the creation of a few energetic men, many of whom had been brought up, or had served at one time or other, in the Military Train, and who simply disregarded all that had been organized by their own Department in time of peace.

Its success, to my knowledge, was largely due to what may be called the military element brought into it from all sides; especially that part which was the result of a measure suggested by Sir John Power in 1867, and carefully worked out and carried into effect by my friend Commissary-General Watt. I refer to the accession of a number of the best non-commissioned officers of the Army in the capacity of Quartermaster and Conductor.

Before I leave the subject for the present, I wish to add, that, to this resuscitation of the military element in the shape of the highest type of military supervision procurable in the Army, by the tempting offer of the posts I have mentioned, I attribute, what Lieutenant-Colonel Shervington would, I imagine, call the salvation of the Transport and Supply Departments of the Army from radical separation.

The experience gained in the American War of Secession commends itself, as also giving practical instruction, all tending to clear the atmosphere of discussion on this subject of organization.

The races engaged, the variety of country and climate, the rapid expansion from the most meagre peace footing, are circumstances very analogous to those in which we exist.

Any student of the history of those wars will concede that all the organization was essentially practical.

The Quartermaster-General's Annual Reports of 1862, '63, '64, and '65¹ give the most detailed accounts of the work done. The experience produced shows a steady improvement in results, until, at the

¹ Printed at Washington Government printing office, in 1880.

end of the war, the Transport Service may be said to have almost reached perfection.

In the present Regulations¹ of the Army of the United States one can clearly trace the results of those experiences of seventeen or eighteen years ago. For instance, the lessons learnt and applied in the working of their Quartermaster's Department in their great war, instead of causing desire for change, or for some new experiment, have confirmed that Department in all its transport functions.

Surely we ought not to pass by and leave these experiences unapplied to our own circumstances.

We find the Quartermasters of battalions, brigades, and divisions, and a Quartermaster-General of an Army. His prime responsibility in war is for Transport.

He has nothing to do with subsistence except to see to its transportation.

The Quartermaster of Transport receives stores, subsistence, or cash into his charge, and such articles are deemed to be *turned over* to transportation when requiring to be removed.

Under Article LXXX of the Regulations, the Subsistence Department is described, and it is charged with the purchase, issue, or sale of all articles of human food, and the Officers are called Commissaries.

The only means of subsistence for which the Quartermaster is responsible is forage.

The Quartermasters of Trains command and conduct them; when several trains march together the Senior Quartermaster takes command. But if a train is under special escort the Commander of the escort takes command of the whole.

With the Army of the Potomac, which began the campaign in 1864, and numbered 125,000 combatants, the Chief Quartermaster had under him 4,300 wagons, 835 ambulances, and had to forage an aggregate of 56,500 horses and mules, which latter included the cavalry and artillery.

The Regulations I refer to lay down minutely the amount of transport to be assigned by the Chief Quartermaster to each unit, down to so small a one as of two Staff Officers detached alone.

The proportion assigned to the Subsistence Department and to the Reserve Ammunition is also carefully detailed.

In the war, all the military drivers and their non-commissioned officers belonging to the transportation trains were armed and equipped, so that special guards were rarely required.

To Lieutenant-Colonel Hildyard the Institution is greatly indebted for his compilation on the Administrative Departments of Continental Armies, published last year in the Journal, and I propose to interest you a little more in this question of organization, by referring to some facts given by that Officer.

¹ United States Army Regulations and General Orders in Force on the 17th February, 1881; for copies of which I have to thank my friends Commander Goodrich and Lieutenant Theo. B. M. Mason, of the United States' Navy.

His clear description of the German Train Battalion system, describes the Military Transport Service as a special branch, "having a strictly military organization, with the command of which the Intendence has nothing to do."

The peace establishment of the Train Battalion of one corps, consisting of two companies, composed of 10 or 12 Officers and over 200 non-commissioned officers and rank and file, expands when on a war footing to—

2,238 of all ranks,

611 wagons.

2,216 horses.

For the whole Army, the peace establishment of 5,040 of all ranks, and 2,457 horses, expands to 39,236, and 46,017, with the carrying power of 12,584 wagons.

This regular Train is assigned by regulation to the different units, according to their necessities, the Supply Branch receiving so many columns for the transport of provisions.

It is interesting to note that of the total of 1,760 carriages and 6,500 horses forming the total transport of one Army Corps, about *one-third* are assigned to the Commissariat.

The Army Corps Train is under the command and conduct of the Senior Officer of the Train Battalion.

Lieutenant-Colonel Furse, in dealing with the question of Administration of the Transport Service, does not appear to have himself arrived at a clear and definite conclusion.

He describes, how, the advocates of what is called the purely military Direction have come to the conclusion that want of experience in time of peace has made it necessary for the Transport Service to resort for assistance and even for administrative ability to the general body of Officers in the Army; and, how, the Commissariat considers that the failures and shortcomings in war lie only at the door of defective organization and deficient means in peace.

Of which side is right Lieutenant-Colonel Furse has not recorded his opinion, but he is definite enough in his insistence on *preparedness*.

Like most writers, he splits on the rock of reconciliation of the conflicting conditions in peace and war. He allows the probable success of there being one administration for supply and transport, but insists on a separate executive. He says: "The Officers of the first, confining themselves solely to supply, of the second, purely to the work of carrying, the same Officers not having to attend to both duties, and carefully abstaining from interfering in controlling the branch to which they do not actually belong." With him Lord Wolseley "*rather concurred*," when he spoke in this theatre in 1881, and added: "I think it is impossible in war to dis sever transport from the supply services;" but continued "in working these two services together I would keep their functions as distinct as it is possible to do so."

Lieutenant-Colonel Furse's division of the duties is described by the

following: "The duties of the two branches are thoroughly different," and he accentuates the distinctions between them so much, that a reader would suppose that there can be little advantage in their being even under one head. It is even not quite certain whether the head he advocates is the Commissary-General, the Chief of the Staff, the Quartermaster-General, or a General of Communications.

Lord Strathnairn's Committee saw the great truth which coincides with Lieutenant-Colonel Furse's apparent conclusion, and gave birth to the Controller.

That Committee had a glimpse of the *true* solution which late experiences have rendered clear. But so rapidly was it obscured, that we find Colonel Clifford Parsons, in this room in June, 1879, after recapitulating the arguments in favour of supply and transport being under one head, drawing the conclusion that the simple separation of the Store Branch from the Control, meant a conviction that the Supply Branch, or Commissariat, should remain in control of everything else.

That *truth* was clearly described in this theatre for the first time, I think, by Lord Wolseley (then Sir Garnet) in 1881, when he said: "I have no hesitation in saying the man who should be held responsible for feeding an Army in front, should be the Officer in command of the line of communications," and "that it is only possible in that way to get over the friction which will always exist between the various departments of the Army," and "it is necessary, in my opinion, that all these departments should, like the strands of a rope, be brought together, as they would be under the Officer in command of the line of communications."

Here we see the resurrection of the spirit of Control under a new name, with attributes extended beyond the dreams of its authors, but *limited in duration to war time*.¹

Under this Head we can concentrate supply and transport, on mobilization. At his side will be the Commissary-General of the Army instead of at the tail of the General-in-Chief. To him will be attached the directors of land, water, and railway transport; and every indication of the duties of these departments and of mutual help, will be given by this "*Man of business*" of the Army.

This clear demonstration of duties will lead up to the long hoped-for disappearance of the unwieldy mixture in one man of Staff and Executive functions, and the irresponsible responsibility of departmental staff will be a thing of the past. There will no longer be a plea for the retention at the side of the Commander-in-Chief of Commanding Officers or heads of departments. Those who surround him will be Staff Officers pure and simple.

The "*business men*" of the Army will be under one head and free to devote themselves to the work for which they are responsible, and they will be directly under the chief "*business man*" of the Army, whose duty it is to relieve the General Commanding of all details.

¹ I cannot too strongly impress my belief that the Department of the General of Communication should have no existence in peace, and that it should be created for each war when the want arises.

A result will be, that *the transport which moves with the units of the Army, call it regimental or brigade, can be on the smallest scale, because the chiefs of supply and transport will be in honour bound to push forward subsistence as near as possible to the mouths of the consumers.*

All feeling which may exist in the Commissariat against irresponsible superintendence of their work will disappear, because their General will not have his attention necessarily centred on the enemy.

The title given to the Administrative Chief referred to, when first employed in Natal, Zululand, and Transvaal in 1879, namely, "Inspector-General," was misleading. An inspector inspects the command of others. It is not the title of an Administrator. Towards the end of 1879 he was confirmed in the functions of command which he had exercised all along.

In Egypt the title of General of Communications was at once conferred on the Officer holding the office.

These two instances are remarkable examples of the difference in scope of the duties falling to the lot of two Officers occupying the same office, and may fairly be quoted as examples which prove that all rules for the guidance of their command, laid down in time of peace, must be tentative.

In Africa the administration of an immense transport, distributed over many hundreds of miles of line of communication, came entirely under Major-General Sir H. Clifford during the last half of 1879. In Egypt the road transport may be said never to have worked under Major-General Erle. In the one case, the whole transport service was created by the war (army service wagons being too few to count), and it was never more efficient than when it came to be broken up. In the other case, it was the best that the Commissariat peace organization could bring to the front, and it was only subject to severe strains during three weeks.

While the principles of administration will remain the same, the details of working will all differ under the influence of, strength of army, length of communications, activity of the enemy, and resources of the country.

In colonial wars, or in countries wanting in supplies, the regimental transport will work as close to the consumers as possible; its duties, as in Zululand, may be confined to carrying a reserve of subsistence, only to be used when the supply cannot reach them.¹ In a rapid move over a short distance, as in Egypt, the regimental transport may have, on the other hand, to take the largest share in distribution.

In a European war the system elaborated by the Germans, namely:

1st, of depending on the country supplies obtained by cash payments for the first day or two; next, on the Intendance for supplies brought from the base, or, in default of those being up, on the Corps provision columns; and, lastly, on the reserve of compressed food carried by the men or by the regimental transport: would present

¹ The Field Force Regulations gave two ox wagons, nominally carrying 4,000 lbs. each, to every company of infantry, and, in proportion, to other arms; as the General Supply Transport accompanied the columns, this was greatly in excess of actual needs.

quite a different mode of procedure for the administration of a General of Communications and his departments, *and especially for the application or distribution of the means of transport available on mobilization.*

But in all these examples the expression "line of communications" defines better than ever, so long as its margin is elastic, the difference between regimental or brigade transport, including ambulance and ammunition, and the general transport of the Army.

Very lately Lieutenant-Colonel Hildyard's interesting contribution to our Journal has clearly described a condition connected with the movements of an army as old as war itself, namely, how the key to the reduction of transport moving with the field forces lies in the system of drawing in the first instance on local resources.

His description of the German arrangements is well worth perusal, and shows how the regular supply of the soldier is assured under all but most exceptional circumstances.

How, after the country is exhausted the troops can be separated from all but their regimental transport for three days, and with their proviant columns from their communications for seven days more.

That these arrangements made in time of peace are liable to dislocation in war was often exemplified in Germany, but their peace manœuvre practice has always been used to give the troops experience in the most difficult part of the application of the system, namely, *the distribution and use of the reserve food which is already in their charge.*

It may be worth dwelling on how far any experiences our troops have at home in peace resemble the conditions lately encountered in Egypt.

The effect of the separation of the brigades of the 2nd Division when the flank move was made to Ismailia, showed how easy it is to upset arrangements for supply and transport made suddenly out of an unsuitable or inelastic peace organization.

Apparently the intention in England was to make the Division the unit, and all things were settled with that view.

The actual case was, that in one sense, the supply and transport services of the 2nd Division may be said to have never assembled.

In the first place, it was embarked in vessels the sailing of which was not connected with that of the transports conveying the divisional headquarters and the troops.

As they arrived they were sent on to Ismailia from Alexandria, thus being more distantly divorced from their unit, one brigade of which remained at the latter place, and picked up its supply and transport where and how it could.

The other brigade remained in its transports in Lake Timsah, while the supply and transport services destined for the Division were almost dissipated in the *mêlée* of demands arising out of the wants at the base and on to Kassassin. In fact, the Highland Brigade, instead of having all the Division transport at its service, was mostly served by its regimental means, until the arrival of the battalions at Benha, Tantah, and Belbeis.

On disembarkation at Ismailia the regimental wagons carried the

food of the brigade to meet its wants to the 11th of September inclusive. For the 12th and 13th it drew rations from the Kassassin dépôt, so that the Commissariat Staff of the Division was occupied chiefly in supervising the distribution, in other armies a regimental duty.

The Commissariat and Transport Corps Company allotted to the brigade, *should* not have been required with it, but *actually* supplied a serious and unforeseen want. The transport of No. 11 Company shared the loads of the regimental transport on the march of the 10th, and carried many footsore and exhausted soldiers on the 11th of September.

In the next operation, which followed the Battle of Tel-el-Kebir, the three sections of No. 11 Commissariat and Transport Corps Company, forming what might be called the provision train of the Highland Brigade, succeeded in transporting 11,000 rations from Tel-el-Kebir to Zagazig. The troops carried nothing to speak of, and these rations, intended for the 14th and 15th, were only brought with the help of camels captured from the enemy, and, I believe, the only vehicles taken on that march by the column were Maltese carts.

From Zagazig on, the transport ceased to be regimental or divisional, and marched as one column by road to Cairo.

If this brigade had had regimental transport suitable to the desert, capable of carrying three days' rations, and its brigade provision column with four days' more, it might have been independent of the services of the Commissariat, except at the advanced dépôt, and have always had three days in hand, to say nothing of the local supplies actually purchased in Zagazig by the Commissary of the Division.

The fact is, the weight carried by road or with the troops was quite insignificant in comparison to that forwarded by railway, or even by canal. The circumstances of the campaign were so far exceptional that the military transport was called on to perform in it but a very minor rôle. This should be distinctly understood, lest it become a matter of uncontradicted assertion that the experience gained proves anything special in favour of our present system.

If anything has at last become a matter past discussion, it is, I believe, that the regimental, medical, and ammunition transport, shall not in future be a Commissariat organization in the British Army.

Lieutenant-Colonel Furse and every writer I have consulted agrees in this; but the Commissariat will tell you that *their* connection with the transport employed for all subsistence and stores must be closely maintained.

Let us consider what arrangements each view of the subject entails, and begin with the latter. The first thought of the Commissariat must ever be the transport of that for which they are primarily responsible in peace, and that is *food*. Can they ever help looking ungrudgingly at those wants which *must* have the first claim, namely, regimental, medical, and ammunition?

If the only transport having a military organization which we possess in peace is controlled by the Subsistence Department, does it not stand to reason, that, the necessary assignment of most of it to the area of

operations with which the Commissariat has least to do, must render both it and the department to which it has belonged inefficient at a most critical moment?

Our existing peace establishment is evidently so curtailed that if the three wants, I have mentioned, of a full army corps are *well* met, nearly the whole available means *must* be so assigned. Supposing such to have been done, and many of the best Commissariat Officers, non-commissioned officers, and men, practically separated from their Chiefs in time of peace, whom they know, and under whom they would wish to distinguish themselves, will the superior Officers of the department be happy in having lost the services of the best means on which they rely for the far greater task of raising and organizing the general transport required to move their supplies? And will they care to devote the further labour necessary to keep up the efficiency of that part of the transport, which, being exposed to the heaviest wear and tear, requires in consequence the most vigorous maintenance? While human nature is, what it is, such an unnatural procedure cannot be expected and will not result.

Mr. Parkyn, Deputy Superintendent of Stores, in his evidence before Lord Strathnairn's Committee, in November, 1866, describes the division of transport into "combatant or light" and "non-combatant or heavy;" the former he places as forming an integral part of the field army. We find the instance of Artillery and Engineers maintaining their own transport, in peace, quoted by many as a reason for the establishment of a third nucleus for military transport, viz., Army Transport.

The principles on which these are maintained, or will be maintained in future, are equally applicable, namely, large reserves of locomotive *matériel*, small cadres of *personnel* and animals.

I will at once turn to my friends in the Commissariat, and ask them to face what such a proposal means:—

Army Transport, on a purely military footing, combatant in every sense of the term, stationed at our camps, the consequent diversion of funds and appointments now administered by that department of the War Office.

The probable performance by contract of all other carriers' work at most garrisons, with a consequent saving, which would go some way to cover expenditure elsewhere.

The loss to the department of a means of training Transport Officers and men, a means, which, as I have shown, must at present be but very partially productive to the Department itself.

It also means, that when war breaks out, the labour of finding transport for the three needs I have mentioned will not fall on the Commissariat; they will only have to be told, according to the nature of the country and the campaign, *where* the margin of their duty will lie, beyond which they need have no care for transport with the Army.

It is quite certain that all concerned will be favourable to that margin lying as close up to the Army as possible, and, to the point of distribution being as coincident as can be with the point of exchange, between, the supply and subsistence service, and the Army Transport.

If the Commissariat sees its way to the remunerative employment in our garrisons in time of peace of the nucleus of a *general transport*, another wise measure of great utility is open to consideration, but I myself am more sanguine of the success of the department if it turns its energies to the perfection of arrangements for rapidly placing a purchased or hired transport in the field when wanted.

I was employed in such an operation previous to the Abyssinian War, and was much struck with one or two facts affecting this view. One was the complete absence of information of any practical value on the subject of the best way of rapidly procuring transport mules in Turkey in Europe and in Asia Minor, without indulging in extravagance; and this absence was acknowledged by the War Office, although twelve years before our Commissariat agents had overrun those countries for the same purpose.

Although the operation I refer to, which was directed by Colonel Clarke Kennedy, concentrated 10,000 mules at Suez, well within the time specified by the Indian Government, my private account of my own share led me to record that any one previously furnished with the experience I had gained at the end, could have procured the 900 mules and 600 horses which were purchased under my supervision in half the time.

Our more recent purchasing experiences in North and South America should enable the Intelligence Branch of the Commissariat to be in a position at any moment to say where animals, wagons, and harness, can be bought up, and how transported, in a very short time.

But if we can have such information accessible, as regards foreign countries, how much more ought we to have it compiled, and the records kept up, as regards this country: so that, if it came about that we had to operate in a country where our English wagons and carts could work, we should be in a position to buy what we want in the most inexhaustible market of the world.

I have mentioned the Intelligence Branch of the Commissariat as if it was existent, but of that I am not in a position to assure the meeting; if it is not, it seems to me, that its absence should be a far greater cause of self-reproach to that department, than if it was to lose the control of the purely military transport of the Army.

The restrictions of the area of control and direction of transport by the Commissariat, already sketched out, will, if established, be the means of doing away with, what I am glad to find Lieutenant-Colonel Furse also agrees to, namely, the expression of *non-combatant* applied to any Officer holding Her Majesty's commission. The area mentioned will be, *that* under the command of the General of Communications, whose Staff, Chief of Departments, and subordinates, can seldom have a claim greater (or less) than the Commissariat to be considered combatant.

However heterodox the idea may seem to received doctrines, the classification of combatant and non-combatant commissions *must* cease in time. Its consequences *must* be faced, and provision made for the custom of the Service as regards *command* being regulated, so that no risk can be run through the inexperience or unfitness of an individual

(to which every branch of the Service is liable) for such a position, if in the service of a line of communication the necessity should arise.¹

Some Transport Carriages.

All evidence at my disposal points to four-wheel carriages being the staple means of military transport. Of known forms we have—

- (1.) The general service wagon with and without springs.
- (2.) The large American buck wagon as used in our South African mule train.
- (3.) The Western American mule wagon of two sizes, as made for the United States Army.
- (4.) The German proviant wagon.
- (5.) The ordinary country wagon used in Continental Europe.

The general service wagon² of the newest pattern is built strong enough for what the Official Treatise on Military Carriages describes as "*not to suffer from the twisting strains.*" In other words, it does not yield to the necessary strains when the wheels are at considerable differences of level. To procure facility for turning in a small circle, and at the same time stability, a large floor is obviously necessary to save height of load, hence additional weight in the structure. It is a well-constructed wagon capable of carrying heavy weights on good roads, but it is *not suitable* for the general transport of the Army. It is perfect for parade purposes, and for showing-off equipment, but much too "fine" and costly. I know that the present Commissary-General, Sir Edward Morris, is strongly of opinion that immediate steps should be taken to replace or largely supplement it by some suitable conveyance in two or more sizes.³

Practical experience of the wagon was afforded by the nature of the work done between June and October, 1879, by a company of the Army Service Corps, stationed at Landman's Drift.

In the neighbourhood and within three days' march were twelve military posts,⁴ where supplies were stored, so that when detachments were employed between one post and another, only food and forage for the intermittent halts had to be carried. But when transport was required for longer distances, on roads where no supplies were stored, the General Service wagon could not be used, as the space left by the rations for load was so reduced that it became absurd to despatch so large a body of horses and men to achieve so little. Besides, owing to

¹ This view is opposed to the idea expressed in one part of the Report of Lord Strathnairn's Committee, viz. :—

"That the Officers of the Army Transport shall have military command limited to their own corps, and should not be employed on any duty unconnected with transport."

This expression of opinion should not debar Officers of that branch from qualifying in other duties by the same roads as are open to Officers of other branches.

² Content of body, 59 cubic feet; content up to the bales, 120 cubic feet.

³ The Woolwich wagon was described by Lord Strathnairn's Committee as built more after the system of Ordnance carriages than that adopted by public carriers.

⁴ Ladysmith, Dundee, Newcastle, Utrecht, Baltespruit, Conference Hill, Koppe Alein, Fort Newdigate, Fort Cambridge, Rorke's Drift, and Helpmakaar.

the deterioration of the animals, the total load rarely exceeded 10 cwt., and two days' rest in seven had to be allowed. The headquarters of the company had to remain stationary, as it soon largely comprised dilapidated animals and material.

The *primitive* wagon, as I shall call it, is one of which the characteristics are met with in all Continental country four-wheel carts, which have formed for centuries the chief means of Army transport in Europe. These characteristics are bulk of load obtained by *length*, not by widening the floor, stability by keeping the load as *near the axle as possible*; elasticity of structure, by *absence of rigidity* in all joints and connections, and toughness of material. The drawback is the limited turning power.

The evidence before Lord Strathnairn's Committee led them to advocate the plan of *locking under*. I can find *no* proof that the necessity arises out of any other conditions than those of our crowded and narrow town thoroughfares.

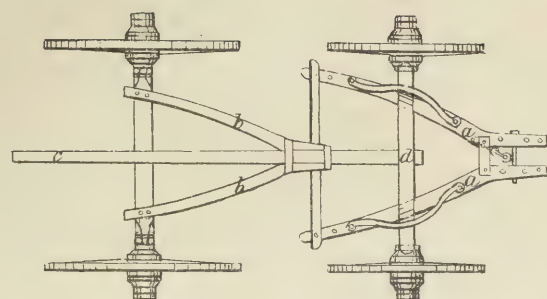
Rigidly constructed carriages only offer an elastic resistance to the draught when springs are added, because there is then less dead pull on the collar. Hence we find both sources of evidence, the Carriage Department and the Carriers, advocating springs, as well as, locking under. These add to the height of the load and to the cost of construction. Many of us have watched the wagons of primitive forms in India, at the Cape, and on the Continent, none of which lock under, and, are quite able to form an opinion if the disadvantages are so great as to make it necessary to sacrifice everything to being able to do so.

I have long made it an object of observation, and I have seen these primitive wagons on the march in war in all the countries named, and can recall very few occasions of difficulty arising out of the limited power of changing the direction of the front wheels, and, I cannot imagine a case in which extrication could not be had, by possession of the means of shifting the draught to the rear of the carriage. This question of *locking under* must be faced, without reference to the wants of our Commissariat wagons used for distributing supplies in garrison towns; and I think the arrangement of under-carriage in the United States' wagon, of which I show a diagram, will help. (See Plate.)

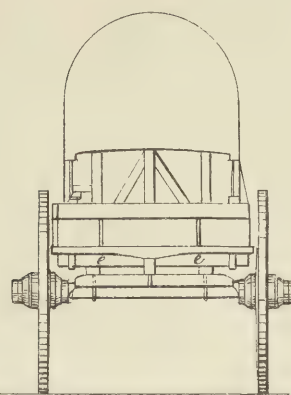
Driving from the seat seems to have gained favour, but like all traditions on the subject derived from what is not the practice of the Artillery, it has been very slow. In 1879 I find Colonel Clifford Parsons repeating here the arguments against it. He says: "It is generally admitted that for transport which must of necessity accompany the troops, be the roads good or bad, the postillion fashion should be maintained, as by it difficulties are surmounted which would be insuperable to wagons driven from the box." The experience of our mule train wagons in South Africa supplies an example which more than refutes this idea. The buck-wagon, of which an illustration is given,¹ was drawn by ten or twelve mules, harnessed two abreast, and driven from

¹ An illustration is also given by Lieutenant-Colonel Furse, that now given is slightly different.

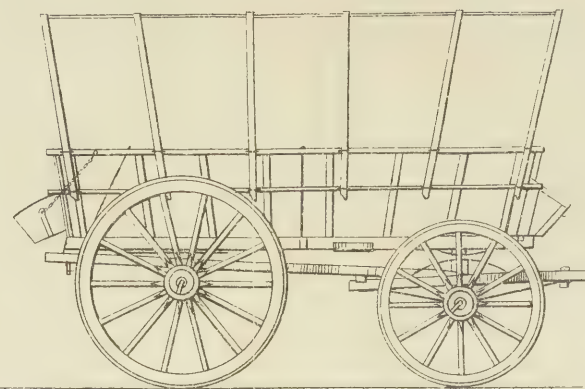
6 MULE, UNITED STATES ARMY WAGON.



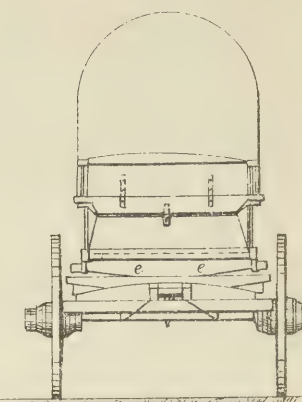
TOP VIEW OF RUNNING GEAR.
(Brake omitted.)



REAR ELEVATION.



SIDE ELEVATION
(Brake omitted.)



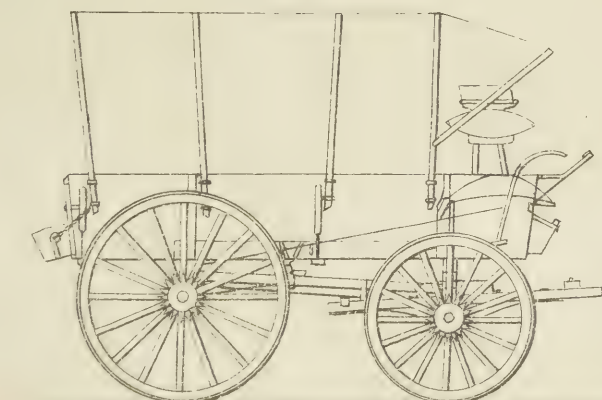
FRONT ELEVATION

References.

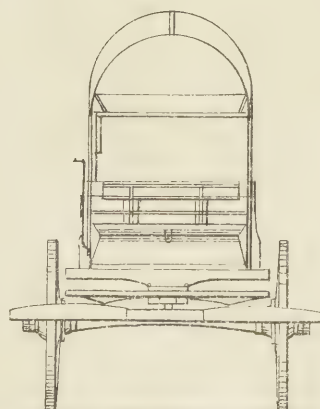
- | | |
|---------------------|---------------------|
| a. a. Front hounds. | c. — Coupling-pole. |
| b. b. Hind — do. — | d. — King-bolt. |
| e. e. Bolster | |

SCALE 1 0 1 2 3 4 5 FEET

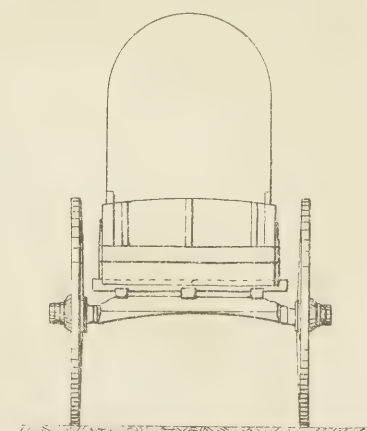
2 OR 4 MULE, UNITED STATES ARMY WAGON.



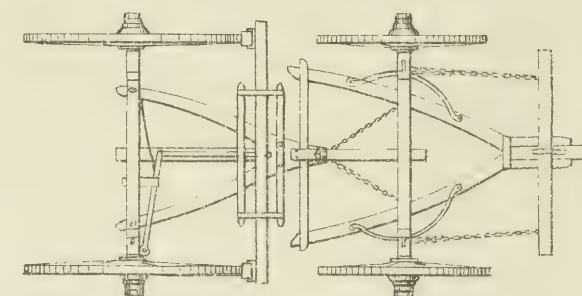
SIDE ELEVATION
(With brake.)



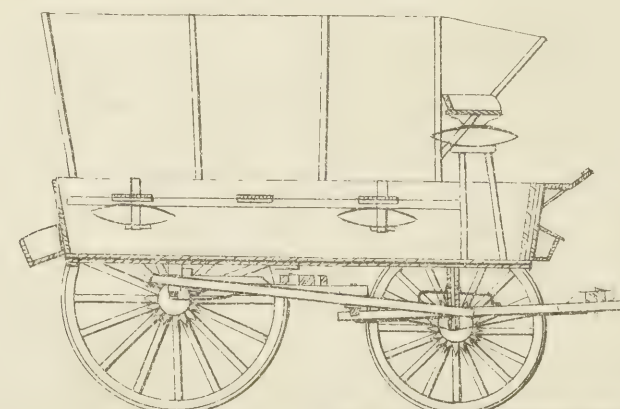
FRONT ELEVATION



REAR ELEVATION



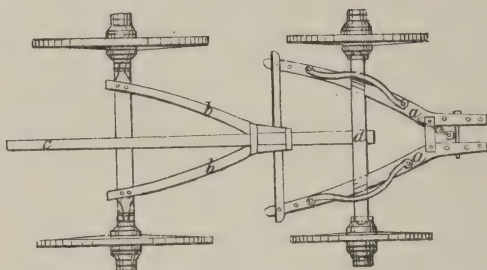
TOP VIEW OF RUNNING GEAR.
(With brake.)



LONGITUDINAL SECTION THRO' CENTRE.

Scale of feet
1 0 1 2 3 4 5

6



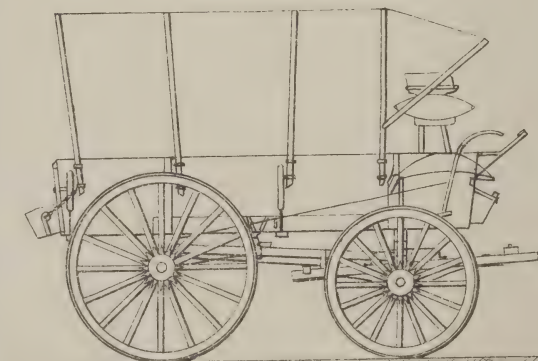
TOP VIEW OF RUNNING GEAR.
(Brake omitted.)

References.

- | | |
|--------------------|---------------|
| a.a. Front hounds. | c. — Coupling |
| b.b. Hind — do. — | d. — Kin |
| e.e. Bolster | |

SCALE 1 0 1 2 3 4 5

2 OR 4 MULE, UNITED STATES



SIDE ELEVATION
(With brake.)

Scale of feet

FT 1 0 1 2 3 4

the seat. The trains passed over the most difficult ground, and through every sort of drift, and rarely came to grief. The two drivers work together, one having the reins, the other the whip; their handiness with the latter being of first importance.

The United States' Army wagon, of which illustrations are given of the size which is drawn by four, and by six, horses or mules, is to my mind the *champion war wagon of the world*. (See Plate and Appendix.)

It is the outcome of long experience in the Far West, and of the troubles about army transport which arose at the beginning of the great War of Secession. The models of wagons and harness are the result of practical experience, and the wheels and principal parts are made with such accuracy as to be interchangeable.

Major-General Rufus Ingalls, Chief Quartermaster, reporting in 1864, writes: "I do not think the kind and amount of transportation for the Army can be improved upon." This refers to the six-mule wagon which carries 1,400 men's *short* rations, and eight days' rations of *short* forage for the mules.

The annual report of the Quartermaster-General of 1865 states as follows:—"The baggage wagon and harness, the general equipment of the trains of our armies, are of models which probably cannot be improved. They have borne the rough usage of war in the hands of men of little experience."

Captain Whitterly, Chief Quartermaster of the 20th Army Corps, writing January, 1865, and describing the march from Atlanta to Savannah between 15th November and 31st December, 1864, a total distance of 281 miles, with 598 army wagons and 105 ambulances, reports: "I cannot suggest any defect in organization, personal or material, of the department; on the contrary, everything seemed to prove the ability, foresight, and skill of the Generals and chiefs of the departments."

There are very many burning questions connected with my subject to which I can do no more than allude.

One, in which I believe Transport Officers take much interest, namely, the regulations under which all transport equipment has to pass in the field through the Ordnance Store Department, causing delays at the very time when every moment is valuable.

Under this legacy from the Control the Transport still groans. Their equipment gets mixed up with all the other army stores. It is taken from the landing-place to the Ordnance Stores, when it ought to go straight to the Transport. It is liable to be temporarily misappropriated, and there is great delay in obtaining an issue owing to the laudable "limpet" nature which the Ordnance develops for the articles in its charge.

Few of those engaged in late wars but have suffered in this way, through the existing peace store arrangements. Time may be of great importance, and yet it may be unavoidably taken up by the demanding department finding out what articles and quantities are really in store, and by the issuing department themselves finding out what they have.

I believe I am quoting the words of an Officer of great experience, in saying that the heads of departments in the War Office would fail to understand the difficulty of getting hold of stores, not from the fault of any individual, but to the peace system, which is not capable of alteration on an emergency.

Late experiences on active service could describe the unavoidable confusion that occurs during the first week after the disembarkation of an Army and its equipment, and the necessity of reducing the number of channels through which equipment has to pass, which is required for immediate use.

If time had allowed, I should have liked much to refer to the use of the Maltese cart, or for lighter work the service pattern garrison cart on general service wheels, which is well adapted for one mule.

The question of the collection, the compilation, and maintenance of a record of the resources of other countries, especially as to mules, has been mentioned: it is one to which a single paper might alone be devoted.

Regulations for the employment of hired or purchased civilian transport in the field, on the lines of communication, require to be framed. I can recall the names of several Officers of the Commissariat, and of other branches attached to the Transport in South Africa, whose experiences would be of great value, and who, if brought together, could draw up an excellent simple guide to Officers and conductors for the future.

Such an experience as that connected with the breaking up, discharge, or re-formation for other purposes, of the great Transport which entered Zululand in May, 1879, would be useful.

I have not referred to a School of Transport. It has often been advocated before. I believe that there are no two opinions on the need for one. It cannot come favourably into existence under the present system. It must be one of the earliest products of the changes I recommend. Any one who has followed the strides which have been made in the means of acquiring knowledge of their profession by Officers of the Army must feel sure that the power to acquire a knowledge of transport duties will be eagerly taken advantage of by numbers. All who have watched the interest taken in the organization of a practical military transport by our leading General Officers, must feel sure that there is no chance of such a Corps being allowed to degenerate into a sham.

If one of the mule train sections employed on the line Pietermaritzburg—Fort Weber (already mentioned) was reconstituted, we should have a sample of one of the most effective transport services this country has ever had, which could be altered and improved on, until every objection was met. One of these sections of 13 wagons required 1 conductor, 1 non-commissioned officer, and 26 drivers, and carried an available weight of nearly 20 tons over very rough roads at an average rate of 20 miles a day, halting at the end of every fourth day, or 80 miles in 5 days.

I submit to the meeting that the chief proposals contained in this paper are moderate. They amount to the complete separation in time

of peace of Supply, and what may be called Army Transport, and the organization of the latter branch on a purely military footing, from which every condition which implies what is called non-combatant shall be expunged; the establishment of a School, not only of *instruction*, but of *examination* in the subject of army transport, connected with the peace cadres: the most rapid transfer to the Reserve of Drivers, of every man who has been trained and served sufficiently long to take his full share in the training of others; the adoption of wagons on the principles of construction followed in the American buck and army wagons; the distinction between, Army Transport in peace and war, and, what may be called, line-of-communication or General Transport; and the establishment of what may be called a Transport Intelligence Officer, whose duty will be, to be able at a day's notice to guide the authorities straight to all the sources of supply of animals, drivers, and wagons, in the world.

If I do not precisely indicate my own view as to who should raise and organize this great General Transport, when the need arises, it is because I feel that the only important decision on the subject which is *now* required, is that referring to the Army Transport, and that, as has always been the case and always will be the case, the best man available for that kind of business, whether, in the Commissariat, or elsewhere, will be selected when the time comes.

The CHAIRMAN: I see present several gentlemen who have taken great interest in the transport question, and I am sure some of them will wish to express their opinions on the propositions made by Colonel Webber, which are almost all contained in the last paragraph but one.

Major-General BRAY, C.B.: I should like to make a few remarks on the lecture we have just heard. The first thing that astonishes me with regard to this lecture is, that in the year 1883—that is, 250 years since the organization of the English standing army—it is necessary for a field Officer to stand up in a public room and lecture on the necessity of having an organized and proper transport for the British army. It is quite right to do so, because we know for a fact that the English army is absolutely without a proper transport. In every war in which it has been engaged the transport has broken down. In every war that is begun, transport has to be initiated; in every war that is finished the transport has to be got rid of; so that at this moment the English army is just as much without a transport as it was 250 years ago. This should not be so, because the English army has greater experience in matters of transport than any army in the world. We move all over the world, and have opportunities of seeing war in every country in the world; we therefore should have more experience and more knowledge, and, what is more, we should be able to apply it, and that is precisely what we do not do. The reasons for all this, in my opinion, are mostly political. It is very difficult for the Government of the day to keep up the necessary nucleus of transport that is absolutely essential in all countries, and until that is done Colonel Webber and his successors may go on lecturing for ever and a day, and you will have no transport. I have seen armies moving in many parts of the world, and I have seen transport of various kinds. In India the transport is wonderfully well managed, because you have the most efficient Commissariat service in the whole world; but you must bear in mind that the transport there is entirely under the control of the Commissariat Officers—in this way, that when war breaks out, they have the power to requisition every carriage and every animal in India, under the authority of the magistrates of India. Now I should like to see the Secretary of State for War in London issue an order to impress all the transport and animals in England for the purposes of war. Why he cannot do it even in peace time: of course for war in England they would have the power to do it, but they have not the power to requisition any-

thing, except on very extraordinary occasions, in this country, and they do not do it. The transport in Afghanistan was very successful. It cost a great deal of money, and it was strictly regimental transport—that is to say, it was divided under two heads: supplies were moved by the Commissariat, and under their directions, and every regiment had its own regimental transport—that is to say, the animals were given over to the Colonel and Quartermaster, and divided amongst the Officers of the companies; they had nothing whatever to do with the transport Officers of the army. The same plan was adopted by Lord Napier, in Abyssinia. There, when he landed, it was the usual confusion all over the place, which cost immense sums of money, and when Lord Napier landed he organized it in the same way as I am speaking of in Afghanistan. The mules were served out to the Colonels of the regiments for the regimental transport, and the transport Officers had nothing to do with it, until the end of the campaign, when they took them over. That transport was most successful, and that is the only successful transport I have ever seen. In Africa, in 1879, in the case Colonel Webber alludes to, immediately after the battle of Isandlwana, the transport broke down in the most astounding manner. Fresh wagons had to be hired at enormous expense; they could not impress them from the colonists, and they had to pay whatever the owners chose to charge. The sums paid were simply enormous. I recollect one requisition was sent to me, for three wagons for three months, and the Officer paid 80*l.* a month for each wagon to the Boers, the ordinary sum charged in Africa in time of peace being 15*l.* Now, as regards regularly organized transport, you have not far to go to see a nucleus. If you go over to Belgium you will see that army, that never goes to war, organized with a perfect system of transport on a most economical plan. Every regiment has a regimental transport; the infantry have their *fourgons* and horses, the cavalry have their *fourgons* and horses, and the horses that they have, are those which are of no use for riding in their regiments. They are not fit for parade and not fit for riding, but they are capital horses for drawing wagons about the town. The consequence is, you see all over Belgium the military *fourgon* and the military transport, all regimental; they do not belong to the Commissariat, but to the regiment. I asked the Colonels of the regiments about it, and they said it was well done and managed, and cost comparatively next to nothing. There is one way by which I think the Government would arrive at a regular system of transport, and that is by offering some inducement to Officers of experience in the army to come forward and make suggestions; but, in order to do so, there must be some advantage to be gained. Give money rewards for that sort of suggestion, and you will very soon find people come forward and make them. These suggestions should not be lost: they should not only be printed, but the Officers should gain by them. At present, as we know, many energetic Officers send in suggestions to the Horse Guards and the War Office, and you never hear, from that day to the end of time, what has become of them. At the end of the Zulu War, every General, every Colonel, and every Officer holding a high appointment, was called upon to send in a report on everything connected with the campaign. Transport was one important point, and each General and Colonel gave his views upon it. No doubt many of the reports must have been very good, and most interesting, but I have never heard what has been done with them since. In order to have a regular system of transport, you must have a nucleus that must be kept up in every regiment in time of peace. There must be a small number of men,—a very small number would do,—I should think a non-commissioned officer and two men, or a non-commissioned officer and four men, with one Officer who really understands the thing, and can keep it going. A very small thing would do, just enough to work their own supplies about the town—a couple of wagons with four horses, or something of that sort, that could be expanded rapidly in time of war, because you would have people who understood it thoroughly, and it could be done. Then, as regards keeping up the nucleus, the saving of money would be enormous in the end, because of the extravagant waste of money, which is something terrific, when war breaks out. Then the soldiers have it all their own way: they can order what they like. They say, “If you stop us you must be responsible for the failure.” The War Department won’t be responsible for the failure, and then we get the money. But in time of peace the money cannot be got, and that is the real reason why you never have a transport, and you

never will, until the War Minister is able to make the House of Commons thoroughly understand how necessary a thoroughly good transport is to the efficiency of an army like the British army, and to insist on a regular organized system of transport becoming a part and parcel of the establishment of this army.

Colonel SHERVINGTON: I have listened with great interest to the very comprehensive lecture that we have just had the pleasure of hearing, and I think there are but few present who will not concur generally in the opinion expressed by Colonel Webber. The British army is the only one in Europe which confides the organization, discipline, and administration of its transport to one of its civil departments. Our able lecturer has told us how it is organized in the German army. In that army, I believe, the commissariat and the supply services of every kind are placed under the direction of a General Officer when they take the field. The transport is a separate and distinct service, supervised by an Officer of ability, who is subordinate to the General Officer commanding the lines of communication. Other armies, like those of Italy and Russia, have none but a regimental transport, which in a measure has a decided advantage over a more general one, in that it looks after the individual requirements of the regiment to which they belong, and is therefore always at the advanced posts of the army. We are aware, as Colonel Bray has said, that the Indian Commissariat is second to none; they hitherto have had charge of the transport service. I am not quite sure, however, that it is generally known that it has been suggested, of late, to make an alteration even in the Indian Commissariat, with regard to transport, and to withdraw it from their direct management and control. The extraordinary difficulties, the enormous responsibilities, and the multiplicity of the duties which devolve upon the Commissariat in war, render it absolutely necessary that they should confine the whole of their attention to the collection of those supplies which the transport should convey along extensive lines of communication to the immediate presence of the troops. Reference was made to London, and to the impossibility of requisitioning its transport, and the animals which it contains. Notwithstanding the large supplies that reach London, few of those who provide the supplies have anything to do with their conveyance to those who require them. We have amongst ourselves in London one of those large dépôts which is well known to all of us, supervised as it is by intelligent administration, watchfulness, and care. I refer to the Army and Navy Supply Stores, where they find you almost everything which you can desire. Yet I have never heard it was proposed to provide their own transport to convey supplies to their distant customers about London. I doubt indeed if they would succeed, either practically or financially, if they did so. They are quite satisfied to summon the aid of Messrs. Carter and Paterson, who conduct the supplies, without either difficulty or trouble, to the most distant parts. The lecturer spoke about the wagons, and I think that question is a very important one. The wagon before us just now has much in common with one built in North America by Colonel Clarke-Kennedy and myself. We brought a pattern home to the Royal Arsenal of Woolwich. It had a chain to prevent complete lock under, which I think is almost a disadvantage in army transport. There is no necessity for it, because any difficulty arising from getting round a corner may be easily avoided by taking proper distance and moving quietly. The lecturer spoke in favour of driving from the box. I think, except on good roads, this is a pernicious system; the driver is more likely to drop asleep, and, with one hand holding the reins, the other the whip, he is liable, when traversing uneven and broken ground, to be jerked off. Several drivers have met with serious accidents at Aldershot in consequence. I think, therefore, that the saddle, where a driver is more likely to be kept awake, and would be more careful where he puts his horses' feet, is the best place for transport drivers. I am persuaded all transport must be military, under a specially selected military Officer, and that a General Officer, as chief of the civil staff of the army, should take the supervision and direction of all the supply services in time of war. I often hear the Officers of the Commissariat say that they cannot be held responsible for the supply of provisions unless they have the transport under their command. Now I am one of those old soldiers who think there is only one man responsible in the field, and that is the Commander-in-Chief. The Officers of the Commissariat are, no doubt, answerable to him for the collection and provision of the supplies; but the Commander-in-Chief alone is responsible that they are duly issued to the troops.

Colonel EAST, Assistant Quartermaster-General, Intelligence Branch: I wish to offer one remark, with reference to the suggestion made by the lecturer, that the Commissariat should establish an intelligence department for the collection of information regarding transport animals and wagons available in foreign countries. It is only right to mention that in the War Office this information exists in every detail for every country, not only in Europe but in all other parts of the world, from which transport animals and wagons could be conveniently obtained. This information was at the disposal of the Director of Transport and Supplies and of the Commissary-General during the recent preparations for war in Egypt.

Major-General LAURIE: I do not wish to go into the question of the organization of transport, but I feel I may offer a few remarks on the subject of the suitability of the vehicles that have been referred to by Colonel Webber. I have lately returned from British Columbia, and I was rather struck with the means of driving that are there adopted. With four or six horses I noticed that one man drives and sits on one of the wheel horses, and they maintain that that is the best method of driving over rough roads, and the handiest that can be adopted. I mention that as an alternative suggestion to having a postillion on every pair of horses, or a driver sitting on the box. The principal wagon road in British Columbia skirts the Fraser River with precipitous banks, sometimes with a sheer fall from the road to the river surface of 1,200 to 1,500 feet, and here, if anywhere, good and careful driving is wanted; the road is narrow and rough. Slides from the cliff above, and gullies in the road-surface, require constant attention and skilful handling of team; yet this is the plan adopted, whether by Americans from the Western States, Canadians from the Eastern Provinces, or men coming fresh from the old country, so there must be good reasons for the plan. Of course two or more teams generally travel in company to lend a hand in difficulties, or double teams in a bad place. I can speak with some experience of the wagons such as Colonel Webber has put before you: for in amusing myself in clearing up a rough bush farm in Nova Scotia, I have been in the habit of working wagons such as those referred to. I have had them in every possible place that a wagon could be put into, and I have hardly ever succeeded in breaking them. They are wonderfully strong and wonderfully handy; we get them into a bad place, and we can get them out again. With a handy team, and sometimes a very awkward driver, we can save these wagons, when a wagon of other construction would be almost certain to go. With a judicious handling of the double tree, you can take your horses out of the front and attach them to the rear of the wagon, so that if you cannot pull your wagon forward you can pull back. I have constantly seen my teamsters take the team to the back of the load and haul the wagon out backwards instead of forward. Our idea of vehicles is that we should give them as little rigidity as possible, all the play we can, and they last many times as long as they would if made rigid. The more play the better; it will carry a load all the better, and will work the better over very rough land. It is the same with our sleds, for use in the snow in winter, in hauling timber and very heavy material: they have so much play, they look as if they would crush down under a load, but they stand very much the better for this, especially from the side jerks that they meet with on rough land, and which would strain them and destroy them if they were built rigid. I may mention, as another great advantage of these wagons, that the body is, so to speak, a separate part, and when it is disabled the carriage part is as strong and serviceable as ever for moving timber, lumber, and any other lengthy and solid substance; we often remove the body, putting a light bolster on the front axle, and let the load ride directly on that and the hind axle. They run very easily and carry a great weight, according to their appearance. I have moved a steam-engine boiler, 22 feet long, and weighing 4,700 lbs., over 18 miles in an afternoon with three horses, on a rough and hilly road. The wagon had 2½ inch axles, and had been in use amongst stumps and stones, in the roughest part of my farm for over ten years. By changing the pole to an ox-tongue it is readily fitted for oxen.

Assistant Commissary-General E. HUGHES, C.M.G.: I should like to say a few words about Colonel Webber's lecture. It would almost require another lecture to go fully into all the points of which he has spoken with regard to the Commissariat transport; and therefore it will be impossible for me, in the short time that I can

now speak, to go really into everything that he has said. I may say, however, that every Commissariat Officer from experience would enunciate most strongly the principle that Colonel Webber also agrees in, namely, as to the necessity of keeping the supply and transport together. He would put them into the hands of the General Officer in charge of the line of communications, and that is a principle which is not at all antagonistic, I think, to the feeling or wishes of any Commissariat Officer. The object of all of us is to get at what is the right thing to do, and our endeavour has been for many years past to go step by step towards many of the points which Colonel Webber has himself urged, and which are very necessary. We are certainly in favour of bringing our duties thoroughly into the hands of the General Officer, putting them under his control as completely as possible, and removing them from what we might call the civil control: we wish to change it from being a civil department into as military a corps as possible. The great difficulty has been, as General Bray remarks, that when any extensive proposition has been put forward by Commissariat Officers, the question of money has always stood in the way. We wished to have an increased corps: we ourselves wished that the regiments should be equipped with transport, but the difficulty has always been the want of money. One point which we have striven for for a very long time has been obtained, and recently: that is, that we should be removed from the department in the War Office, who look so very much after the money, and go to the Horse Guards, who look to efficiency as the first thing, and money as a secondary matter. That alteration has recently obtained, and we trust by this means for the future to be able to strive towards efficiency more than simply for economy. As to the different points of organization which have been mentioned, I agree that the regiment should have its transport, should have it always with it, and should not be separated from it. The only point on which I should disagree with Colonel Webber is, that he would take it so far away from the Commissariat that he would not have any one of the Commissariat staff or corps in any way connected with the regimental train. Now my own experience has been, that when the transport has been manned out of the regiment, it has not been the best men who have been detailed to undertake the duties, and certainly not the best Officers. The duties the regimental transport Officer would have to do would very often lead him to a position away from the place where he would be able to acquire distinction, and so it results that, when the British Government wish in time of war to organize regimental transport, it is not the best Officer who is willing to undertake that duty. It might often be (as really was the case at Tel-el-Kebir) that, in the time of great actions, the regimental transport Officer would necessarily be rather left behind. In order to have a regimental transport, the right plan would no doubt be to have certain Officers and men detailed for each regiment, and I would take them from the Commissariat; they should always be kept with the regiment, and it should be the rarest exception in the world that they should have to leave it. The point of being under the command of the General of Communications is another one that the Commissariat have always striven for, namely, that the General should feel himself as responsible for their part of the duty as he does for the duties of any of his staff Officers. The difficulty has always been to get a General Officer to realize this, and therefore to admit the responsibility; if they would, it would be also exactly what is wished for by the lecturer. There are many other things which Colonel Webber has taken up that one would like to mention, but it is impossible to go into all without, as I say, another lecture. I should, however, be sorry that this meeting should separate without its being thoroughly understood that there is another side of the question, and that the Commissariat Officers are as anxious for progress, in the direction that every one here seems to desire, as any person can possibly be.

Colonel Sir LUMLEY GRAHAM, Bart.: It appears to me that all who speak and write upon this subject are quite agreed with regard to one question, and that is as to the necessity of having regimental transport in the first line. Though there may be some difference of opinion as to details, every one is of opinion that there should be a special regimental transport told off for carrying the immediate supplies for the troops, besides the rations which they always should carry on their persons for use in time of emergency. Here the question of cost comes in; they say you

cannot keep up the nucleus of this transport in peace time, because you cannot afford the money for it. But now it has been settled that we should at least keep one Army Corps always ready for immediate service—almost on a war footing, so as to be able to embark at any moment, it seems to me a farce to keep the corps ready for service, without the means of moving it, so that I should think it would be a very good expenditure of money, if we do not choose to supply all our regiments with a nucleus of transports, at least to supply the regiments that are first for service with it. It would not be a very large expense. Again, as we may be called upon to carry on war in any part of the world, would it not be advisable that a nucleus of the transport particularly applicable to the special country should be kept up in each of our colonies, such as the Cape of Good Hope for instance, where wars constantly crop up? That would be a great assistance, and, I believe, in the long run a very great economy. You would have stopped that enormous rush after buying and hiring things which has been so graphically described by General Bray. By the bye, referring to what General Bray said, may I be allowed to make one remark? He spoke with great praise of the way in which the transport service is conducted in India, and there is reason to believe that, comparatively speaking, it is good. I can, however, hardly think that it deserves the extraordinary praise that he gave it, seeing that whenever there is a great Indian war we find, if there is not a breakdown, that breakdown is only prevented by a fearful expenditure of animals and money. In the first expedition to Afghanistan, before Sir John Keane's column got even to Candahar, they had expended something like 25,000 camels, and I believe in the last Afghan War, the expenditure of camels amounted to something like 50,000—not to mention other animals. That, we are led to suppose, was owing to the incomplete arrangements,—that the people who had charge of those animals did not know how to take care of them—and that in a great measure they were lost, owing to the incomplete peace arrangements, as the people in charge¹ had not been properly trained in peace time for the care of the transport in war. I only speak by hearsay with regard to these matters; but I should like, if possible, to have further information on the subject.

General BRAY: In the Afghan War there were nothing but camels used, because there were no carts in the country. The carts from India would not travel over that country: they would have been smashed to pieces. There are no roads at all: they are all boulders. The camels all belong to the owners, and the owners are with the camels the whole time and actually take care of them. There were Officers to look after the transport, but no soldiers to look after the camels in the Afghan War—the owners looked after them; general supply being managed by the Commissariat, the regimental carriage by the regimental commanders.

Sir LUMLEY GRAHAM: I was alluding to the Officers in charge of the transport department.

General BRAY: Which? The supply or the regimental?

Sir LUMLEY GRAHAM: I am referring to the whole transport.

General BRAY: The transport supply of the first Afghan War was under a Commissariat Officer, but the regimental transport was under a regimental commander: that was the distinction; but the camels were actually tended, fed, and groomed by their owners.

Sir LUMLEY GRAHAM: Were they not divided into sections?

General BRAY: Not in the first Afghan War.

Sir LUMLEY GRAHAM: They were in the second?

General BRAY: No; not in the first Afghan Wars, from 1839 to 1842.

Major GRIMSTON: I think the real reason why we break down in our transport in war is because in peace everything is done by contract: all our food and every part of our supply is brought to the man's mouth almost, by contract. You cannot get those contracts abroad, and therefore when you go to foreign

¹ By the "people in charge" I mean the Officers and non-commissioned officers detached from regiments to make up for the want of regular transport Officers, who, though as a rule zealous and hardworking men, were, in many cases, unacquainted with the habits of the animals, biped and quadruped, under their charge.—L. G.

countries you are unable to get your work done, and you have no transport. You do not want the transport in England, where everything is brought to you, and you have nothing to carry. If the Commissariat would take the trouble (they won't thank me for saying so) to do at home what they have to do abroad—that is, to bring all the supplies to the regiment, and do the contractor's business, then we should find plenty of nucleus for our regimental system of transport, and we should then get on very well; everybody would be accustomed to do as they would have to do abroad. The real fault, as I say, is that we have large contracts for bringing everything, because by that means it is easily done, and we save trouble. With regard to the American wagon which Colonel Webber has shown us, it is a very beautiful thing, but it strikes me that the body is rather too narrow: I do not see any object in its being so narrow, further than this—the wheels will not lock if broader; but if there was a slope in the side, instead of its being perpendicular, the wheels would have just as much play, and the wagon would contain a great deal more than it does at present.

Colonel WEBBER: Mr. Chairman, I think you will agree with me that, as no very important objections have been made by the speakers to the points which I have had the honour to-day to submit to the meeting, it would be taking up your time fruitlessly if I were to attempt to say much in reply. I have been glad to find that the meeting seems to acknowledge the clearness of my propositions, for no remark has been made asking me to elucidate any of them. I think they are mostly (as you, Sir, have said) contained in the last sentence but one, and I would ask any gentleman interested in this subject to glance over that paragraph, and perhaps when they get their number of the *Journal* they may be interested in looking through the papers, and then I think they will find almost every observation that has been made by those who have been kind enough to speak to-day has been partly if not entirely answered. The subject was so large that it was quite out of the question for me to attempt to refer to the great work that has been done by the Transport Department in India of which General Bray has kindly reminded us. Colonel Shervington's observation on the subject of *Postillion Riding* is answered in the paper, and I think it will be accepted by any one who has seen the way in which, not Africanders, but Army Service Corps men, move those teams of mules in South Africa to which I have referred. I had twenty-two of those sections, each composed of thirteen wagons, passing frequently under my supervision, and there were as many Englishmen who had learnt to use the whips as there were Africanders. If you had seen that you would never have thought of putting an extra weight either on your wheeler or your leader, whether for the purpose of keeping the man awake or saving his bones in the event of an upset. I was greatly pleased with the testimony that has been given to the efficiency of this beautiful American wagon. I think that if two or three such wagons were brought over to this country and used over rough ground and driven with full loads, as they are done in America, my admiration of them, and the title I have pretended to give them, namely, of being the champion army wagon in the world, would be fully borne out. I may say that his wagon weighs in itself only about 1,600 lbs., and it will carry a full load of 10 cwt. With reference to what Sir Lumley Graham has said as to the advantage of maintaining, in addition to a nucleus of a regimental transport in this country, examples of transport used in other countries, I would like to say one word, which is, that if we had maintained in England, before the South African War, a South African ox-wagon, and used it here and got experience of it, I do not believe we would have acted differently. After hundreds of those ox-wagons had been in use, the authorities sent to America for wagons and mules, for what proved to be our most efficient train. It does not, therefore, follow that the wagon which we may adopt in the future for general service may not be as suitable a wagon for any country as that indigenous to it.

The CHAIRMAN: Gentlemen, so many Officers have spoken, and the time is so short, that I shall confine myself to offering a very few remarks before asking you to return your thanks to the lecturer. The difficulties connected with English transport are far beyond those of any other country. Never does one war follow another in which the same transport is required, and the idea of keeping up a nucleus of transport in each country, as suggested by Sir Lumley Graham, is totally imprac-

licable. For instance, could a nucleus of bearers on the coast of Africa, or a large transport force of mules in Abyssinia, be maintained? There is no necessity for this nucleus in South Africa, as the wagons can be horsed, or you can have the buck wagons, which, as Colonel Webber said, the men are soon taught to use. We cannot afford even to keep up a nucleus in England; much less could we afford to keep up a nucleus abroad. The question appears to me to be how we can best utilize the small funds which are at our disposal for transport. Some think, and I quite agree, that it is quite necessary to maintain a nucleus of regimental transport in time of peace. Other nations—Russia, Germany, and Austria, Italy, Belgium, and France, all have a regimental transport, and why are we, who pride ourselves on our regimental system, to differ from other nations? Why is it necessary that we should have a detachment furnished by the Commissariat attached to a regiment? For my part I think it would be very much cheaper to train a few men in each regiment for transport duties under an Officer of the corps. My experience has been totally different from that of the gentleman of the Commissariat Department who spoke to-day. I have always seen the very best Officers volunteer for the regimental transport; I have known very indifferent Officers volunteer to go to the Commissariat; but if they were with their own regiment, the Colonel would take very good care that, where so much depended on the Officer, he would not allow even indifferent Officers to be employed for transport duties. The argument of self-interest goes completely against what the gentleman I referred to, has said. Colonel Shervington spoke about Carter and Paterson and the transport of the army. I believe they are excellent organizers, and I believe we could not get better men to put at the head of transport duties, but as we have not got Carter and Patersons in every country it would be totally impossible to rely upon them in order to deliver our stores to the Commissariat; and the Commissariat must have an efficient transport, as they are responsible for feeding the army, but whether the regimental transport should be under that department is a matter of opinion. I beg to return our sincere thanks to Colonel Webber. His lecture has been most instructive: it is a lecture which shows that he has gone thoroughly into the subject from beginning to end; and the question as to which plan we are to adopt, whether the transport is to be under the Commissariat or in charge of a military train or regiment, depends upon which plan can be carried out in the most convenient manner. We must adopt the cheapest plan, for we have not got money to try experiments in different kinds of transport. I have been in America for many years, I have travelled over all sorts of roads in those wagons which Colonel Webber and General Laurie have mentioned, and my experience is that they never break down: they are the best wagons in the world for rough roads. A Committee sat in London some years ago to select the best wagons for military purposes, and whom do you think were asked to give an opinion upon the subject? Why the carriers of London, who never go off the smooth roads, and their opinion was in favour of high spring wagons certainly, which were the best for their purposes but the worst for army purposes. I beg to return our sincere thanks to Colonel Webber.

A FEW NOTES

ON THE

PURCHASE OF MULES AND HORSES IN 1867 IN TURKEY.

ALTHOUGH the conditions have been probably affected by the waste which occurred on account of the Russo-Turkish War, the general circumstances are not materially changed since 1867.

Approximate secrecy of the intentions of the British Government to make Turkey the scene of purchase operations is important. In 1867 this intention

became generally known (*abruvité*), through Her Majesty's Consuls, who had received instructions from the Foreign Office to spread the news. The effect was at once to raise the price all over the country, and time was lost in waiting for the effect to subside.

Negotiations at Constantinople should be avoided; they will only be with bankers and agents, who will employ other middle-men.

Animals can be procured at the provincial towns, by either contract or agency.

If time is an essential condition, contract is the best means, if solvent contractors can be found who are willing to be bound under a heavy penalty. The men who become contractors should be known to be inland merchants who are acquainted with the interior of the country. They will submit to their own local commercial agents.

The disadvantages of contracts, are, that the prices are high, the *best* animals are not procured, while sometimes others which, if cheap, would answer certain purposes, are rejected, as not being worth the contract price.

If direct agency is employed, the purchase of animals may commence *at once* in a large number of small centres, and the agents need not be under any penalty. A specification of the kind of mules required can be sent to each and a day named for the visit of the inspecting Officers. The English and foreign Consuls would frequently undertake to collect animals on the prospect of their being passed, owners would take the risk, and the inspecting Officers might often pass animals not *quite* up to the mark at reduced prices.

In such a case the inspecting Officers should have an interpreter. A slight knowledge of Turkish or Greek, so as to check the interpreter, would be of great use.

By contract, one thousand mules should be obtainable, of the quality described, delivered on board ship at any port in the Levant, for 23*l.* a head.

The contract should not be completed without the contractor first placing a sum of money to the credit of Her Majesty's Secretary of State for War in the nearest bank, amounting to about 1*l.* per mule, as, first, a proof of his real intentions and ability to carry out the contract, and, second, to cover any penalties that may be exacted. This was required from, and complied with by large contractors at Smyrna in 1867, and proved a most salutary measure.

The contractor should take all responsibility up to the ship's side. The contract should specify, besides the age and height of the animal, "*the average of the first quality of pack mules procurable in the province of,*" &c. Also, that, with each animal, should be delivered—

1 new head-stall and rope.

1 nose-bag of camel's or other hair, weighing not less than 11 ozs.

1 back-pad of felt and hair, with surcingle.

1 kicking-rope.

1 set of spare shoes and nails.

The contract should allow that the mules may be branded or marked at any place which suits the convenience of the inspecting Officers, but, that such branding or marking shall not imply delivery.

If purchase by contract, as described above, is followed, one Officer, provided with a printed form of the terms in English, Turkish, and Italian, should leave England at once and proceed to the East, and complete the contract, and, having arranged for the dates and places of delivery, telegraph home for parties of inspecting Officers to follow. Each inspecting party should be composed of two Officers, one being a Veterinary Surgeon. Each party should be provided with branding-irons, one for the flank and one for the hoof; also, with two sizes of pack-saddles, so that each mule, when being examined, may be easily tried with a load on his back.

If the system by agency is adopted, inspecting parties, as described above, should proceed to any one or all of the places mentioned below, provided

with cash in gold, so that every animal can be paid for when passed. Before commencing operations each party should engage an interpreter, at 3*l.* a week, and a head muleteer, at 1*l.* a week.

In Turkey in Europe—

Lagos.

Carvalho or Serez (near Salonica).

Widdin, on the Danube.

Janina, in Albania.

In Asia Minor—

Trebizonde.

Ineboly, west of Sinope.

Broussa.

Aidin.

Islands of Mytelini and Chios.

Adalia.

Tersus.

Larnaka, in Cyprus.

Another Officer should proceed to Constantinople, to arrange for the supply of cash to the various parties and of transport from the ports of embarkation.

By employing the khanjees, syces, and farriers, to be met with in the bazaars, and sending them into the district to collect mules on certain days at convenient points for inspection, about 300 to 500 mules could be procured in a fortnight at each of the points named at an average cost of 15*l.* Their keep after delivery will come to about 1*s.* 3*d.* a day, and their share of the wages of muleteers about 6*d.* a day per mule.

At Trebizonde mules are not bred, but plenty of good ones arrive daily with loads from Erzeroum. Once, the carrying trade employed upwards of 16,000 pack animals. On the routes from Trebizonde to the interior they could be bought for 12*l.* to 15*l.*

An agency at Ineboly should employ persons engaged in the wool trade, who would buy at Kjankany, Tusia, Amasia, and Kastamuni.

In Broussa about 150 mules can be bought, and a large number is obtainable at Kjutahia.

At Mytelini about 300 good mules are obtainable for about 16*l.*, and about the same number on Chios, and about 50 from the mainland opposite.

Aidin is a good centre from which to purchase in all the south-west of Asia Minor, and the prices range about 15*l.* for mature pack mules.

In 1867 the price of mules in Cyprus was 18*l.* to 20*l.*

Adalia is a good point for collection and shipment.

Adana should be the point of collection from the district north and north-east to Diarbekir.

No Asia Minor mules should be under thirteen hands, nor outside from five to twelve years of age.

There may be said to be three qualities—

1st. The riding mule of upwards of fourteen hands, and costing 20*l.* to 30*l.*, which is more or less scarce.

2nd. The caravan or wood-cutter's mule, bred in the interior, about thirteen hands in height; a strong bony animal, and the kind to be sought for, for military pack purposes.

3rd. The cultivator's mule, which has more of the jennet about him, has probably been rejected by the muleteer, and remains on the hands of the producer who uses him for farm purposes. This last class is of the kind which contractors and agents will first show the purchasing Officers, which they can buy for 8*l.* or 9*l.*, and for which they will ask 15*l.* It should be avoided.

The Roumelian mules are generally of less value, and smaller than those of Asia Minor, and less suitable for the tropics.

At the great Adrianople fair, one of which is held between the 11th and 16th October, a large number of horses and mules can be bought; the prices of the latter range as follows :—

3 to 4 years	12 <i>l.</i> to 13 <i>l.</i>
5 to 6 „	14 <i>l.</i> to 15 <i>l.</i>
7 to 9 „	16 <i>l.</i> to 17 <i>l.</i>

At Widdin and Janina, each, about 1,000 mules could be collected for the above prices.

In 1867, 900 mules were collected by contract at Smyrna for 22*l.* 10*s.*, including delivery at the ship side.¹

They were fair average quality, hard, but in lean condition. Each before being passed was tried with a load of 400 lbs. About 20 per cent. of those offered by the contractor were rejected.

The purchase of mules in the neighbourhood of Salonica should be conducted from Port Lagos and Carvalho. Kemouldjina (? Ghimmurgina), about four hours' ride from Lagos, is the best centre, and there an agency should be established without delay. There, 1,000 to 1,500 could be collected for 12*l.* to 15*l.* In this district purchase should be conducted by agency, not contract; local people could be found who would bring in 80 or 90 mules. The very best mules for exportation to Greece here fetch as much as 22*l.*

Pack horses in large numbers can be purchased in Western Asia Minor. On market day in a town as large as Aidin 50 or 60 were procured in one day, of these 15 were fit for riding purposes; the average price was 10*l.* 7*s.*

A party of inspecting Officers on arrival in a town should seek a commission agent, and engage to pay him a commission on each animal bought on an inverse sliding scale, the commission increasing as the price diminishes. The payment in every case should be made in gold to the owner. The news of this manner of dealing spreads rapidly over the country. At first all the bad animals around will be offered at exorbitant prices; a few days' patience will bring all to its normal level, and owners will be only too glad to sell for ready money for the really good prices I have quoted.

The great thing is for the purchasing Officer to visit one or two remote places quietly, and ostensibly for some other purpose. There, having made up his mind what he will give, stick to the price.

Great expense is gone to in fitting up vessels for the transport of mules, and it is no doubt necessary for long ocean voyages; but when the distances are not great, and in summer weather, large cargoes of mules and small horses may be transported from port to port in the Mediterranean with very little fitting by spreading on the main and upper decks a layer of coals.

Mules of the size bought in the Turkish dominions can be penned with spars or boat-oars lashed to uprights, nailed to the deck, five to eight in each pen. It is of advantage to the animals to stand as close together as possible. By placing each animal a little in front or in rear of his neighbour, 18 inches is enough for each. The breast pole should be exactly 4 feet 8 inches from the back, and 2 feet 9 inches above the floor.

C. E. W.

¹ All these mules were inspected by Veterinary-Surgeon Anderson, R.H.A.

APPENDIX.

THE UNITED STATES ARMY WAGON AND MULE HARNESS.

THE following specifications for wagons and mule harness are taken *in extenso* from those published under the authority of Major-General R. Ingalls, Quartermaster-General U.S.A., Washington, 1882. They are so complete and detailed that any manufacturer could work from them.¹

WAGON.

Specification of Six-Mule U.S. Army Wagon (Covered).

See Drawings Nos. 1 and 2.

The *front wheels* (12 spokes, to have a 3-inch tenon) to be 3 feet 10 inches high, hubs 10 inches in diameter in centre, $8\frac{1}{4}$ inches in front of hubs, and $14\frac{1}{4}$ inches long. *Hind wheels* (14 spokes, to have a 3-inch tenon) 4 feet 10 inches high; hubs $10\frac{1}{4}$ inches in diameter and $14\frac{1}{4}$ inches long; felloes $2\frac{1}{2}$ inches wide and $2\frac{3}{4}$ inches deep; cast-iron pipe boxes 12 inches long, $2\frac{1}{2}$ inches at large end and $1\frac{1}{2}$ inch at small end; tire $2\frac{1}{2}$ inches wide by $\frac{5}{8}$ inch thick, fastened with one screw-bolt and nut in each felloe; hubs made of gum, locust, or the best white oak, well seasoned; the spokes and felloes of the best white oak, free from defects; each wheel to have a sand band and lynch-pin band $2\frac{3}{4}$ inches wide of No. 8 band-iron, and two driving bands—outside band $1\frac{1}{4}$ inch by $\frac{1}{4}$ inch thick, inside band 1 inch by $\frac{3}{16}$ inch thick; the hind wheels to be made and boxed so that they will measure from the inside of the tire to the large end of the box $6\frac{1}{2}$ inches, and front wheels $6\frac{1}{8}$ inches in a parallel line, and each axle to be 3 feet $11\frac{3}{8}$ inches from the outside of one shoulder-washer to the outside of the other, so as to have the wagons all to track 5 feet from centre to centre of the wheels. Axle-trees to be made of the best quality refined American iron, $2\frac{1}{2}$ inches square at the shoulder, tapering down to $1\frac{1}{2}$ inch in the middle, with a $\frac{7}{8}$ -inch king-bolt hole in each axle-tree; washers and lynch-pins for each axle-tree—size of lynch-pins, 1 inch wide, $\frac{3}{8}$ inch thick, with a hole in each end; a wooden stock $4\frac{3}{4}$ inches wide and 4 inches deep, fastened substantially to the axle-tree with clips on the ends, and with two bolts 6 inches from the middle, and fastened to the hounds and bolster (the bolster to be 4 feet 5 inches long, 5 inches wide, and $3\frac{1}{2}$ inches deep) with four $\frac{1}{2}$ -inch bolts.

The *tongue* (or pole) to be 10 feet 8 inches long, 4 inches wide, and 3 inches thick at front end of the hounds, and $2\frac{1}{4}$ inches wide by $2\frac{3}{4}$ inches deep at the front end, and so arranged as to lift up; the front end of it to hang within 2 feet of the ground when the wagon is standing at rest on a level surface; the tongue-cap to be $\frac{7}{8}$ -inch round iron, welded into iron 2 inches by $\frac{1}{2}$, 15 inches long, bolted with three bolts $\frac{5}{16}$ inch diameter.

The *front hounds* to be 6 feet 2 inches long, 3 inches thick, and 4 inches wide over axle-tree, and to retain that width to the back end of the tongue; jaws of the hounds 1 foot 8 inches long and 3 inches square at the front end, with a plate of iron $2\frac{1}{2}$ inches wide by $\frac{3}{8}$ inch thick, fastened on the top of the hounds, over the back end of the tongue, with a $\frac{1}{2}$ -inch screw-bolt in each end, and a plate of iron of the same size turned up at each end $1\frac{1}{2}$ inch, to clamp the front hounds together, and fastened on the under side and at front end of hounds with a $\frac{1}{2}$ -inch screw-bolt through each hound, and a $\frac{7}{8}$ -inch bolt through tongue and hounds in the centre of jaws to secure the tongue in the hounds; a plate of iron 3 inches wide, $\frac{1}{4}$ inch

¹ The publication of the details will prevent the originality of the patterns being appropriated by any Department or manufactory in this country: a kind of piracy of which we are too often guilty, and rather fond of accusing our neighbours.—C. E. W.

thick, and 1 foot 8 inches long, secured on the inside of jaws of hounds with two bolts $\frac{3}{8}$ inch, and a plate of same dimensions on each side of the tongue, where the tongue and hounds rub together, secured with two rivets; a brace of $\frac{7}{8}$ inch round iron to extend from under the front axle-tree and take two bolts in front part of the hounds, same brace $\frac{3}{4}$ inch round to continue to the back part of the hounds and to be fastened with two bolts, one near the back end of the hounds and one through the slider and hounds, and within 2 inches of slider on wagons finished; a brace over front bolster $1\frac{1}{2}$ inch wide, $\frac{1}{4}$ inch thick, with a bolt in each end to fasten it to the hounds; the opening between the jaws of the hounds to receive the tongue $4\frac{3}{4}$ inches in front and $4\frac{1}{2}$ inches at the back part of the jaws.

The *hind hounds* 4 feet 8 inches long, $2\frac{3}{4}$ inches thick, and 3 inches wide; jaws 1 foot long where they clasp the coupling-pole; the bolster 4 feet 5 inches long and 5 inches wide by $3\frac{1}{2}$ inches deep, with steadying iron $2\frac{1}{2}$ inches wide by $\frac{5}{8}$ thick, turned up $2\frac{1}{2}$ inches, and fastened on each end with three bolts $\frac{3}{8}$ inch; the bolster stocks and hounds to be secured with four $\frac{1}{2}$ -inch screw-bolts, and one $\frac{1}{4}$ -inch screw-bolt through the coupling-pole; a substantial stay under each back hound and axle to form a clasp under each, and bolted to hound 18 inches forward of axle, and two rivets through each end of coupling-pole.

The *coupling-pole* 9 feet 8 inches long, 3 inches deep, $4\frac{1}{2}$ inches wide at front end (which will be strapped with $\frac{3}{32}$ by $1\frac{3}{4}$ -inch iron, extending back $9\frac{1}{2}$ inches) and $2\frac{3}{4}$ inches wide at the back end; distance from the centre of king-bolt hole to the centre of the back axle-tree 6 feet 1 inch, and from the centre of king-bolt hole to the centre of the mortise in the hind end of the pole 8 feet 9 inches; king-bolt $1\frac{1}{4}$ inch diameter, of best refined iron, drawn down to $\frac{7}{8}$ inch where it passes through the iron axle-tree; iron plate 6 inches long, 3 inches wide, and $\frac{1}{8}$ inch thick on the double-tree and tongue where they rub together; iron plates $1\frac{1}{2}$ by $\frac{1}{4}$ inch on the sliding-bar, fastened at each end by a screw-bolt through the hounds; two bolts to pass in sliding-bar within 3 inches of hound. Front bolster to have plates above and below 11 inches long, $3\frac{1}{2}$ inches wide, and $\frac{3}{8}$ inch thick, corners drawn out and turned down on the sides of the bolster, with a nail in each corner and four countersunk nails through plate, and sandboard and plate underneath; two bands on the hind hounds 2 and $2\frac{1}{2}$ inches wide, of No. 10 band-iron; the rub-plate on the coupling-pole to be 8 inches long, $1\frac{3}{4}$ inch wide, and $\frac{1}{4}$ of an inch thick.

Tongue, hounds, coupling-pole, axle-beds, and bolsters to be of best quality white oak, well-seasoned; double-tree 3 feet 10 inches long, single-tree 2 feet 8 inches long, all well made of hickory, with an iron ring and clip at each end; the centre clip to be well secured; lead-bar and stretcher to be 3 feet 2 inches long, $2\frac{1}{4}$ inches wide, and $1\frac{1}{4}$ inch thick; lead-bars, stretchers, and single-trees for six-mule team to be of the best quality of hickory; the two single-trees for the lead mules to have hooks in the middle to hook at the end of the fifth chain; the wheel and middle pairs with open rings to attach them to the double-tree and lead-bar; the fifth chain to be 10 feet long to the fork; the fork 1 foot 10 inches long, with the stretcher attached to spread the forks apart; the links of the double-tree, stay and tongue-chains $\frac{3}{8}$ of an inch diameter; the forked chain $\frac{7}{16}$ inch diameter; the fifth chain to be $\frac{7}{16}$ inch diameter to the fork; the fork to be $\frac{5}{16}$ inch in diameter; the links of these and the lock-chains to be not more than $2\frac{1}{4}$ inches long; a cross chain $\frac{7}{16}$ inch diameter, with key and ring, will be required to cross the bed.

The *body* to be straight, 3 feet 6 inches wide, 2 feet deep, 10 feet long at the bottom, and 10 feet 6 inches at the top, sloping equally at each end, all in the clear or inside; the bed-pieces to be $2\frac{1}{2}$ inches wide and 3 inches deep; front pieces $2\frac{3}{8}$ inches deep by $2\frac{1}{2}$ inches wide; front and cross-pieces to have $\frac{1}{4}$ -inch rivet in each end, 1 inch from side rail; tail-piece $2\frac{1}{2}$ inches wide and 3 inches deep, and $4\frac{1}{2}$ inches deep in the middle, to rest on the coupling-pole; top rail $1\frac{5}{8}$ inch thick by $1\frac{1}{2}$ inch wide; lower rails $1\frac{1}{8}$ inch thick by $1\frac{1}{4}$ inch wide; three studs and one rail in front, with a seat on strap-hinges to close it up as high as the sides; a box 3 feet 4 inches long, the bottom 5 inches wide, front side $9\frac{1}{2}$ inches deep and $8\frac{1}{2}$ inches at the top in parallel line to the body, all in the clear, to be substantially fastened to the front end of the body; to have an iron strap 1 inch wide passing round each end, secured to the head-piece and front rail by a rivet in each end of it passing through them; the lid to be fastened to the front rail with two good strap-

hinges, a strap of $\frac{5}{8}$ -inch iron around the box $\frac{1}{2}$ inch from the top edge and one near the bottom, and two straps, same size, on the lid near the front edge to prevent the mules from eating the boxes; to have a joint hasp fastened to the middle of the lid, with a good wooden cleat on the inside, a strap of iron on the centre of the box with a staple passing through it to fasten the lid to; eight studs and two rails on each side; one bolster fastened to the body, 6 inches deep and 4 inches wide at king-bolt hole; bolster to be fastened to body with a $\frac{1}{2}$ -inch bolt in each end; front part of bolster to be 16 inches from front side of front end of sill, and to have a stay under each end and secured to bottom of sill by two bolts; iron rod in front and centre of $\frac{1}{8}$ -inch round iron, with a head on the top of rail and nut on lower end; iron rod and brace behind, with shoulders on top of tail-piece, and nuts on the under side, and a nut on top of rail; a plate $2\frac{1}{2}$ inches wide, of No. 10 band-iron, on tail-piece, across the body; four screw-bolts through each side stud, and two screw-bolts through each front stud; bolts to be $1\frac{3}{4}$ inch by $\frac{1}{4}$ inch to secure the lining-boards, one bolt through each end of the rails; floor $\frac{5}{8}$ -inch oak boards, well fastened to body-bars by wrought nails clinched at bottom; sides $\frac{5}{8}$ -inch white pine; tail-boards $\frac{3}{4}$ inch thick, of white pine, to be well cleated with five oak cleats riveted well and strong at each end through the tail-board; an iron plate 3 feet 8 inches long, $2\frac{1}{2}$ inches wide, and $\frac{3}{8}$ inch thick on the under side of the bed-piece, to extend from the hind end of the body to 8 inches in front of the hind bolsters, to be fastened by the rod at the end of the body by the lateral rod, and two $\frac{3}{8}$ -inch screw-bolts, one at the forward end of the plate and the other about equidistant between it and the lateral rod. A $\frac{1}{2}$ -inch round iron rod or bolt to pass diagonally through the rails between the two hind studs to and through the bed-piece and plate under it, with a good head on the top and nut and screw at the bottom, to be at the top 1 foot 6 inches from inside of tail-board, and on the bottom 10 inches from the hind rod. An iron clamp 2 inches wide, $\frac{1}{4}$ inch thick around the bed-piece, the centre bolt to which the lock-chain is attached passing through it, to extend 7 inches on the inside of the body, the ends, top, and bottom to be secured by two $\frac{3}{8}$ -inch screw-bolts, the middle bar at the ends to be flush with the bed-piece on the lower side. Two lock-chains secured to the centre bolt of the body, one end 11 inches, the other 2 feet 6 inches long, to be of $\frac{3}{8}$ -inch round iron; feed-trough sides of yellow pine, to be 4 feet 6 inches long from out to out, the bottom and ends of oak; sides $8\frac{1}{2}$ inches deep, 8 inches wide at bottom, and 12 inches wide at top of feed-box, all in the clear, or inside; well ironed with a band of hoop-iron around the top, one around each end, and three between the ends; strong and suitable irons to fasten them on the tongue when feeding; a good strong $\frac{1}{4}$ -inch chain to be attached to the top rail of the body, secured by a staple with a hook to attach it to the trough. The running-gear and the frame-work of the body to be neatly chamfered and rounded.

BRAKE.

Brake-bar to be made of best white-oak, $2\frac{3}{8}$ inches thick by 7 inches wide, 5 feet 9 inches long; to be made parallel 2 feet 6 inches, then tapered on front side at each end to $5\frac{1}{2}$ inches. Each end of bar on back side to be gained $\frac{1}{2}$ inch deep and 7 inches long, to receive the brake-shoe, so that the front of the brake-block will be on a line with the back of the bar.

Brake-shoe of flat iron on each end 6 inches long, $2\frac{1}{4}$ inches wide, $\frac{1}{2}$ inch thick, bent around 2 inches on each side to receive a brake-block. Bolted to the brake-bar with two $\frac{1}{2}$ -inch bolts each.

Brake-blocks to be made of best oak, $3\frac{1}{2}$ inches thick, 6 inches wide, 15 inches long, curved to fit the wheels; tapered gains to be cut on each side of sufficient depth and width so as to fit in the above-described shoe and leave the full surface of the blocks presented to the wheel.

Brake-roller to be of $1\frac{1}{2}$ -inch round iron, 5 feet 4 inches long, and about 18 inches, drawn down to $1\frac{1}{2}$ by $\frac{5}{8}$ inch, with two $\frac{7}{16}$ -inch holes in the end, 4 inches apart. Two bracket stops 1 by $\frac{1}{2}$ inch, welded on the roller-bar, the first one 2 inches from the end, and one 2 feet 4 inches from the end; these are to keep the roller from shifting lengthwise between the brackets. Two fulcrums, $1\frac{1}{2}$ by $\frac{3}{4}$ inch at roller-bar, drawn to 1 by $\frac{3}{8}$ inch $1\frac{1}{2}$ inch from the end, forming an eye $1\frac{1}{2}$ inch round by $\frac{3}{4}$ inch, with hole for $\frac{1}{2}$ -inch bolt; the first fulcrum welded on the bar

7 $\frac{3}{4}$ inches from the end of the roller, the other 23 $\frac{1}{2}$ inches, and the fulcrums to measure 4 $\frac{3}{4}$ inches from the centre of the hole to the centre of the roller-bar when finished; the flat end of the bar bent up in a gentle curve in the round part at right angles for a lever 2 feet high; the roller to measure 3 feet 6 inches from out to out when bent, and the top of the lever to stand 10 inches back of a straight line when the fulcrums hang perpendicular in place.

Brackets.—Two brackets which hold the roller-bar in place should be 2 feet 5 inches long, of $\frac{3}{8}$ -inch round iron, with a clip-tie welded on 1 $\frac{3}{8}$ by $\frac{1}{2}$ inch with holes in, to take the hind axle bolts; then 7 inches from the axle form an eye on the brackets 2 $\frac{1}{2}$ by $\frac{7}{8}$ inch, with a hole in 1 $\frac{9}{16}$ inch to receive the roller-bar; then 6 inches of the front end flattened to bolt to the hind hounds with two $\frac{1}{2}$ -inch bolts each, this also taking the place of the hind axle braces.

Brake-hangers.—Two brake-bar hangers 3 feet 2 inches long whole length; top end 1 $\frac{1}{2}$ by $\frac{1}{4}$ -inch iron, welded to 1 foot 2 inches of 2 by $\frac{1}{2}$ -inch iron, with a T welded on the bottom end 1 $\frac{3}{4}$ inch wide, $\frac{1}{2}$ inch thick, 4 $\frac{1}{2}$ inches long, with one $\frac{1}{16}$ -inch hole in each, 5 inches from the bottom end, slightly countersunk on both sides, with $\frac{1}{2}$ -inch round iron link 9 $\frac{1}{4}$ inches long in the clear, with a 3-inch eye-bolt welded in the lower end to bolt through the brake-bar, 3 inches of the top end bent over the top rails and bolted to the top. Middle and bottom rails with three $\frac{3}{8}$ -inch bolts, 4 feet 10 inches from the front end of the body; the top of the brake-bar to hang 3 feet 4 $\frac{3}{4}$ inches from the top of the body.

Lever-bracket.—One lever bracket 5 $\frac{1}{2}$ inches long, $\frac{5}{8}$ -inch round iron, with a $\frac{5}{8}$ -inch collar welded on 3 $\frac{1}{4}$ inches from one end, with a screw and nut to bolt through the centre of the bed-piece or bottom rail, 17 inches from the front end of the body, with nut, washer, and screw on the outer end to take the lower end of the brake-lever.

Brake-lever to be 4 feet long, 1 $\frac{1}{2}$ by $\frac{9}{16}$ inch iron, $\frac{3}{4}$ -inch hole in the bottom end, with three $\frac{1}{16}$ -inch draw-rod holes 3 inches apart; the first one 10 $\frac{1}{2}$ inches from the centre of the bottom hole; the lever-catch 3 $\frac{1}{2}$ inches long formed 20 inches from the centre of it to the centre of the bottom hole, a 2-inch eye on the top end; the lever drawn down to 1 by $\frac{1}{16}$ inch under the eye, and tapered back 15 inches; the top of the lever bent in an ogee shape 6 inches forward of a straight line.

Brake-ratchet, whole length 3 feet 4 inches, one piece, 2 by $\frac{1}{4}$ -inch iron, 15 inches long, with 8 teeth, 1 $\frac{1}{2}$ inches from centre to centre and 1 inch deep, welded to one piece of 1 $\frac{1}{4}$ by $\frac{3}{8}$ -inch iron, 11 $\frac{1}{2}$ inches long, bent around edgewise 2 $\frac{1}{2}$ inches from the front tooth on a circle of 2 $\frac{1}{2}$ inches, on a parallel line with the ratchet side, then bent 4 inches of the end out edgewise at right angles; then bent the same 4 inches down square to fit the front stud on the body and bolted to it with two $\frac{3}{8}$ -inch bolts; then weld on the back end of the ratchet 15 inches of $\frac{3}{4}$ -inch round iron, and on the end of this weld a T 1 foot long, 1 $\frac{1}{8}$ by $\frac{5}{16}$ -inch iron, 4 inches from the lower end of it. This T to have a hole in each end to fasten to the top and middle rails with two $\frac{3}{8}$ -inch bolts, a guard 21 inches long of $\frac{1}{2}$ -round iron to fasten to the ratchet on a parallel line 1 $\frac{1}{2}$ inch from the teeth to keep the lever from whipping against the cover of the wagon; the outer edge of the teeth in the ratchet to stand out 4 inches clear of the body studs.

Draw-rods.—Two draw-rods 2 feet 7 inches long, $\frac{5}{8}$ -inch round iron, with slot clevis made of 1 $\frac{1}{2}$ by $\frac{1}{4}$ -inch iron on one end to fasten to the roller fulcrums with two $\frac{1}{2}$ -inch bolts; the front end to have screws cut 10 inches long, and to pass through the brake-bar, with a nut on each side of the bar, which will allow the bar to be let out or taken up as the blocks wear out.

Brake-rod to be $\frac{1}{2}$ -inch round iron, with clevis formed on each end of 1 $\frac{1}{4}$ by $\frac{1}{4}$ -inch iron, to connect the brake together with two $\frac{3}{8}$ -inch bolts.

Six bows, of good ash or oak, 2 inches wide and $\frac{1}{2}$ -inch thick, with three staples to confine the ridge-pole to its place; two staples on the body to secure each end of the bows; one ridge-pole 12 feet long, 1 $\frac{3}{4}$ inch wide by $\frac{3}{8}$ inch thick; two rings on each end of the body to close and secure the ends of the cover; a staple in the lower rail, near the second stud from each end, to fasten the side cords; the cover to be of the first quality cotton duck, 10-oz., 28 $\frac{1}{2}$ inches wide, army standard, cut 15 feet long and four widths of material, made in the best manner, with four hemp cords 30 inches long on each side and one through each end 13 feet long to close it at both ends. The outside of the body and feed-trough to have two good coats of white lead,

coloured to a blue tint; the inside of them to have two coats of Venetian red paint; the running-gear and wheels to have two good coats of Venetian red darkened to a chocolate colour; the hub and felloes to be well pitched instead of painted, if required.

The extra *king-bolt* and two extra *single-trees* to be furnished with each wagon, the king-bolt and single-trees similar in all respects to those belonging to it.

Each side of the body of the wagon to be marked U.S., and numbered as directed; all other parts to be lettered U.S.; the cover, feed-box, bolts, and linch-pins for each wagon to be put up in a strong box (coopered) and the contents marked thereon. Each wagon to be marked with the name and residence of the maker.

It is agreed and distinctly understood that the wagons are to be so constructed that the several parts of any one wagon will agree and exactly fit those of any other so as to require no numbering or arranging for putting together, and all the materials used for their construction to be of the best quality, all the wood thoroughly seasoned, and the work in all parts faithfully executed in the best workmanlike manner.

The work shall be inspected from time to time as it progresses by an officer or agent of the Quartermaster's Department, and none of it shall be painted until it shall have been inspected and approved by said officer or agent authorized to inspect it.

Weight of wagon about 1,950 pounds.

HARNESS.

Specification of the size, &c., for Six-Mule U.S. Army Wagon.

Wheel.

Two quilors.—Breech-straps 3 feet 6 inches long, $3\frac{1}{2}$ inches wide, sewed into 4-inch rings of $\frac{3}{8}$ -inch iron.

Hip-straps, 3 feet 11 inches long, $2\frac{1}{2}$ inches wide.

Stay-pieces, 2 feet long, $2\frac{1}{2}$ inches wide, with $1\frac{1}{2}$ -inch buckles.

Cross-straps to buckle into stay-pieces, 6 feet long, $1\frac{1}{2}$ inch wide.

Side-straps, 4 feet long, $1\frac{1}{2}$ inch wide.

Tie-straps, 15 inches long, $\frac{1}{2}$ inch wide, tapering to a point at both ends.

Two belly-bands.—Long side 2 feet 3 inches long, 2 inches wide, with a 2-inch buckle; short side 1 foot 5 inches long and 2 inches wide.

Two hair collars, 18 to 19 inches long, with single straps and safe-leathers, and buckle 1 inch wide, and to be high-peaked.

Two pairs strong hames to suit, of white-oak root, ironed, with hooks, breast-rings $1\frac{1}{2}$ inch square, staples and line-rings.

Two pairs hame-straps, lower one 5 feet 6 inches long, $\frac{1}{2}$ inch wide; upper one 4 feet 6 inches long, $\frac{1}{2}$ inch wide, of alum-tanned leather.

Two choke-straps, 3 feet 2 inches long, 2 inches wide, 2-inch roller buckle; billet 20 inches long.

Two bridles.—Crown piece 2 feet long, $1\frac{3}{4}$ inch wide, to be split so as to form straps to receive the buckles of *throat-latch*.

Cheek-pieces, each 10 inches long, 1 inch wide, cut 2 feet 10 inches long, to form billet for bit.

Front pieces, $11\frac{1}{2}$ inches long, 1 inch wide.

Stay-pieces, from blinds to crown piece, 16 inches long, $1\frac{1}{2}$ inch wide. No nose-piece.

Blinds, 10 inches long, $5\frac{1}{4}$ inches wide in swell, to be half-oval shaped.

Reins.—Long side 4 feet long, 1 inch wide; short side 2 feet long, 1 inch wide, with 1-inch buckle.

Throat-straps, 19 inches long, $\frac{3}{4}$ inch wide, buckle at each end.

Bit, wrought-iron, japanned, bright mouth, jointed, to weigh 7 pounds to the dozen.

One chin-chain, 10 inches long, of No. 8 iron, short-twisted links, with S-hook at each end and $1\frac{1}{2}$ -inch ring in centre.

One coupling strap, $6\frac{1}{2}$ feet long, 1 inch wide, with 1-inch buckle.

Two pairs chain pipes, 2 feet 6 inches long, $2\frac{1}{2}$ inches wide.

Two pairs trace-chains, 7 feet long, 12 twisted links to the foot, of No. 2 iron, with hooked **T** on one end, heavy swivel in centre of chain; on front end of trace-chain 6 straight links No. 1 iron, $2\frac{1}{4}$ inches long, weight 10 pounds per pair; (iron to be of the best quality).

One pair breast-chains, 28 inches long, 14 twisted links to the foot, of No. 2 iron; weight 4 pounds per pair.

Two neck-straps, 3 feet 1 inch long, $2\frac{1}{4}$ inches wide, with $2\frac{1}{4}$ -inch buckle.

Two neck-chains, 4 feet 6 inches long, 14 twisted links to the foot, of No. 4 iron; **T** and loop to be riveted on to the neck-strap: swivel in chain; weight 6 pounds per pair.

One saddle, made on tree of the kind known as "Morgan;" the head and gullet in one piece (solid fork); to be covered in the usual manner with raw-hide; leather flaps running under the tree and extending 6 inches below the girthing D; three girthing straps $1\frac{1}{4}$ inch wide each—one running across the tree in front of pommel to the D on the opposite side, another round the pommel to the D's on each side, and the other from the same D's to the extension of the bar behind the cantle, all fastened to the tree with brass screws; one lacing strap on each side from the D's $1\frac{1}{4}$ inch wide, 3 feet long, tapering to a point; one hair girth 16 inches long, 4 inches wide at the middle, a $2\frac{1}{2}$ inch ring on each side; stirrup leather 2 inches wide, 5 feet long, with 2-inch buckles; fenders, or leg-guards 17 inches long, $6\frac{1}{2}$ inches wide at top, $8\frac{1}{2}$ inches wide at bottom. The fender to be removable at pleasure.

Heavy wooden stirrups, 4 inches wide on bottom; 2 rivets.

Four collars, $17\frac{1}{2}$ to 18 inches long, made same as for wheel harness.

Four pairs hames to suit, of same material as for wheel harness, ironed, with hooks, rings, and staples, and with straps, as in wheel harness.

Four bridles, same as for wheel harness.

Four neck-straps and chains, as for wheel harness.

Four belly-bands, as for wheel harness.

Four pairs chain-pipes, as for wheel harness.

Four pairs trace-chains, as for wheel harness.

One bearing-chain, 4 feet long, 14 twisted links to the foot, of No. 4 iron, with a hooked **T** on each end and $1\frac{3}{4}$ -inch ring in middle.

Four cruppers and hip-straps.—Back strap 5 feet long, tapering from $3\frac{1}{2}$ inches to $2\frac{1}{2}$ inches wide; hip-straps each 2 feet 4 inches long, $1\frac{1}{2}$ inch wide, each with 3-inch rings, and a small open ring or **S**-hook to attach it to trace-chain.

Four back-bands, 3 feet 4 inches long, $3\frac{1}{4}$ inches wide.

One martingale, 4 feet long, $1\frac{1}{2}$ inch wide—to buckle into bit.

Four coupling-straps, 5 feet 6 inches long, $\frac{3}{4}$ inch wide.

One check-rein, 4 feet 1 inch long, 1 inch wide—to buckle into the bit at each end, with a ring sewed in the centre to receive the lead line.

One jockey stick—to be of hickory, split with the grain—not sawed—4 feet 6 inches long, with chains, a **T** at end of one chain and a snap at end of the other; chains to be 10 inches long, of No. 8 iron.

One lead-line, 28 feet long, 1 inch wide, with buckle at one end and an 8-inch loop at the other.

Two lead-line rings, 3 inches in diameter, to be attached by a leather strap 12 inches long, 1 inch wide, with buckle; one to the line-ring in the near hame of the near swing mule, the other to the back strap over hip-strap of the near lead mule, the lead-line to pass through these two 3-inch rings.

One whip—black-snake, 5 feet 6 inches long, $1\frac{1}{2}$ inch in diameter at the butt.

The whole, except jockey stick, to be packed in a box 20 inches wide, 20 inches deep, and 36 inches long, of 1-inch stuff, coopered with wood hoops or iron, as may be required.

The whole to be made of the best material—(leather of best quality, oak-tanned), sewing to be made with good waxed thread; and in addition, the quilors, belly-bands, back-bands, cruppers and hip-straps, chain-pipes, neck-straps, and choke-straps to have one No. 9 copper rivet and burr between each two rows of stitches; japanned, malleable, barrel-pattern buckles to be used throughout, and subject to inspection during process of manufacture and also when finished.

Weights of the various parts of a complete set of standard six-mule U.S. Army wagon harness, in use at the Fort Leavenworth, Kans., depôt of the Quartermaster's Department, U.S.A.

No.	Articles.	Wheel for two mules.	Lead for four mules.	Total.
		lbs.	lbs.	lbs.
4	Back-bands.....	..	4 $\frac{1}{16}$	4 $\frac{1}{16}$
6	Belly-bands	1 $\frac{1}{16}$	3 $\frac{5}{16}$	5
1	Bearing-chain.....	..	2 $\frac{8}{16}$	2 $\frac{8}{16}$
2	Breast-chains.....	4 $\frac{3}{16}$	..	4 $\frac{3}{16}$
6	Bridles	6 $\frac{8}{16}$	13	19 $\frac{8}{16}$
6	Pairs chain-pipes	4 $\frac{4}{16}$	8 $\frac{8}{16}$	12 $\frac{12}{16}$
1	Chin-chain	$\frac{4}{16}$	..	$\frac{4}{16}$
1	Check-rein .....	..	1	1
2	Choke-straps	2	..	2
6	Collars—two 17 $\frac{1}{2}$ in., two 18 in., two 19 in.	11	20 $\frac{8}{16}$	31 $\frac{8}{16}$
5	Coupling-straps.....	$\frac{8}{16}$	1 $\frac{8}{16}$	2
4	Cruppers, with hip-straps .....	..	10 $\frac{8}{16}$	10 $\frac{8}{16}$
6	Pairs hames	8	15 $\frac{8}{16}$	23 $\frac{8}{16}$
12	Hame-straps	$\frac{10}{16}$	1 $\frac{2}{16}$	1 $\frac{12}{16}$
1	Jockey-stick .....	..	2 $\frac{8}{16}$	2 $\frac{8}{16}$
1	Lead-line .....	..	2 $\frac{4}{16}$	2 $\frac{4}{16}$
2	Lead-line rings.....	..	$\frac{12}{16}$	$\frac{12}{16}$
1	Martingale .....	..	$\frac{8}{16}$	$\frac{8}{16}$
6	Neck-straps and chains.....	8	16	24
2	Quilors	12	..	12
1	Saddle.....	12 $\frac{8}{16}$	..	12 $\frac{8}{16}$
6	Pairs trace-chains.....	22	44	66
1	Whip.....	..	1 $\frac{4}{16}$	1 $\frac{4}{16}$
		94 $\frac{1}{16}$	149 $\frac{9}{16}$	243 $\frac{10}{16}$

WAGON.

Specification for Two and Four-Mule U.S. Army Wagon.

See Drawings Nos. 3, 4, and 5.

Body.—The body to be straight, 3 feet 4 inches wide, 1 foot 9 inches deep, 9 feet 6 inches long at the bottom, and 10 feet at the top, sloping equally at each end, all in the clear or inside.

Sides, &c.—The sides, strips, head and tail-board, and tool-box of white pine.

Floor.—The floor of yellow pine and the bars of white oak; the floor 9 feet 10 $\frac{1}{2}$ inches long, 3 feet 4 inches wide, $\frac{3}{8}$ inch thick.

Sides.—The sides 22 inches wide, $\frac{7}{8}$ inch thick, 9 feet 9 $\frac{1}{2}$ inches long at bottom, with four strips or cleats of white oak 3 $\frac{1}{4}$ inches wide, 1 inch thick on the outside, to keep the body in place between the standards; the front one placed 1 foot 7 $\frac{1}{2}$ inches from the front end and the other 2 feet 6 inches from the back end; a strip 4 $\frac{1}{2}$ inches wide, $\frac{7}{8}$ inch thick on outside at the bottom, the whole length of side between the cleats; all the strips, cleats, and the floor well nailed with clinch-nails; the top edge of sides and ends of body ironed with hoop-iron $\frac{3}{8}$ inch wide, $\frac{1}{8}$ inch thick, fastened with screws; two oak strips 2 feet long, 2 $\frac{1}{2}$ inches wide, 1 $\frac{3}{4}$ inch thick, bolted to the under side of body, back of the hind bolster, with three $\frac{3}{8}$ -inch bolts in each.

Iron straps.—Eight iron straps (four on each side of body), 20 inches long, 1 $\frac{1}{8}$ inch wide, $\frac{1}{4}$ inch thick, with both edges swedged down to a feather edge, with a

$\frac{1}{2}$ -inch round shank and nut on the bottom to secure the bars, and fastened to the inside of sides with four rivets in each; the first strap placed 5 inches from the front end of side, to receive a bottom bar 3 feet 10 inches long, $3\frac{1}{4}$ inches wide, $1\frac{1}{2}$ inch deep; the second strap 4 feet 2 inches from front ends, to receive a bar 4 feet 6 inches long, $3\frac{1}{2}$ inches wide, $1\frac{3}{4}$ inch deep, with an iron brace on the outside 20 inches long, of $\frac{3}{8}$ -inch round iron, with $1\frac{1}{4}$ -inch shoulder, resting on centre-bar; a $\frac{1}{2}$ -inch shank and nut on bottom, and three bolts through brace, side, and strap, and three rivets through side and strap at the top and bottom; the third strap 6 feet $3\frac{1}{2}$ inches from front end, to receive a bar 4 feet long, $3\frac{1}{4}$ inches wide, $1\frac{1}{2}$ inch deep; the tail strap placed even with the end of side at the bottom to receive the tail-bar, 4 feet 6 inches long, $3\frac{1}{2}$ inches wide, $1\frac{3}{4}$ inch deep, with a brace on the outside 20 inches long, of $\frac{3}{8}$ -inch round iron, with $1\frac{1}{4}$ -inch shoulder, resting on end bar; a $\frac{1}{2}$ -inch shank and nut on lower end, the top flattened out to $1\frac{1}{4}$ inch wide, $\frac{1}{4}$ inch thick, and bent out back to form the eye through tail-gate, bolted through the sides and straps with 4 bolts, and to have 3 rivets through sides and straps; a loose ring, $2\frac{1}{2}$ inches in diameter, of $\frac{3}{8}$ -inch round iron, through a shank riveted to brace at top to receive the tail-chain; feed-box chain 11 inches long, including hook, is also attached to this ring.

Tail-gate.—Tail-gate 3 feet 9 inches long, 1 foot 8 inches wide in middle, and 1 foot 6 inches wide at the ends, $\frac{7}{8}$ inch thick, to close up against the ends of sides, hung with three strap-hinges $1\frac{1}{2}$ inch wide, $\frac{1}{4}$ inch thick, reaching to top of gate, fastened with five rivets in each hinge and three eye-bolts through tail-bar, and a $\frac{7}{16}$ -inch round rod through hinges and eye-bolts. A plate $2\frac{1}{2}$ inches wide, $\frac{1}{8}$ inch thick, on the inside and outside at each end of gate, reaching from top to bottom, riveted with 7 rivets in each. A pin through eye (to hold up the gate), attached to bolt at top of brace by a small chain; a staple of $\frac{3}{8}$ -inch round iron, 2 inches wide, riveted in hinges near the top, to receive a chain 7 feet 6 inches long, links of $\frac{3}{16}$ -inch iron, with a hook at one end and a ring at the other; the tail-bar and floor placed 1 inch outside of the ends of side boards so that the tail-gate will shut on top of floor.

Head-board.—Head-board $21\frac{1}{2}$ inches high, $\frac{7}{8}$ inch thick, with two pine cleats 4 inches wide, $\frac{7}{8}$ inch thick, placed $6\frac{1}{4}$ inches from each end, well nailed with clinch-nails, held in place by 4 oak cleats on inside of side boards, with a tool-box fastened to front side.

Tool-box.—Tool-box 3 feet long, 10 inches deep on front side, $5\frac{1}{2}$ inches wide at bottom, and $8\frac{1}{2}$ inches at top, with a lid hung with two T-hinges and a joint hasp in the middle, and well ironed with hoop-iron $\frac{3}{4}$ inch wide, passing around each end and along the top edge and fastened to front board; a $\frac{3}{8}$ -inch round rod across the body, in front of head-board and above the lid of tool-box, with a handle on one end and a nut on the other.

Side plates.—Four plates $5\frac{1}{2}$ inches high, 3 inches wide, $\frac{1}{8}$ inch thick, on outside of body at standards, turned under the body one inch where it rests on the bolsters.

Bows.—Six bows, of good ash or oak, 2 inches wide, $\frac{1}{2}$ inch thick, with three staples to confine the ridge-pole to its place; the front bow fastened to the second bow with two $\frac{1}{4}$ -inch bolts 18 inches from lower end, and at the top with a leather strap 31 inches long, $1\frac{1}{2}$ inch wide; two staples in sides of body to secure each end of bow.

Ridge-pole.—One ridge-pole 8 feet 8 inches long, $1\frac{3}{4}$ inches wide, $\frac{5}{8}$ inch thick.

Rings.—Four rings on each side of body to fasten the cords of the cover.

Seat-boards.—Seat-board 3 feet $4\frac{3}{4}$ inches long, 14 inches wide, $\frac{7}{8}$ inch thick, with ends and back; ends 5 inches wide; back 6 inches wide in centre and $\frac{7}{8}$ inch thick, of white pine, secured by four corner plates $4\frac{1}{2}$ inches long each way, $\frac{7}{8}$ inch wide, $\frac{3}{4}$ inch thick, fastened with six wood-screws in each; the seat to rest on top of two elliptic springs 26 inches long, $1\frac{1}{2}$ inch wide, two leaves each, to rest on uprights 2 feet $5\frac{1}{2}$ inches long, $1\frac{1}{2}$ inch wide, $1\frac{1}{4}$ inch thick, of white oak, bolted to insides of body with eight $\frac{3}{8}$ -inch bolts. Three movable seat-boards 3 feet $3\frac{1}{2}$ inches long, 2 inches wide, $\frac{7}{8}$ inch thick, with oak cleats on under side, to rest on two side bars of hickory 8 feet 4 inches long, $2\frac{1}{2}$ inches wide, $1\frac{1}{2}$ inch thick, with four elliptic springs 28 inches long, $1\frac{1}{2}$ inch wide, three leaves each, resting on four iron straps 7 inches long, $1\frac{1}{8}$ inch wide, $\frac{5}{16}$ inch thick, bent over and resting on top edge of sides of body.

Foot-board.—A foot-board on the front end of body, 3 feet 4 inches long, 14 inches wide, $\frac{5}{8}$ inch thick, of yellow pine, held in place by two $\frac{5}{8}$ -inch iron braces 19½ inches long, flattened at each end, and two rests 19½ inches long, 1 inch wide, $\frac{3}{8}$ inch thick, secured to front head-board with four $\frac{3}{8}$ -inch bolts and to the foot-board with eight $\frac{5}{16}$ -inch bolts.

Lock-chains.—Two lock-chains, one end 11 inches long, the other 2 feet 6 inches long, of $\frac{5}{16}$ -inch round iron, attached to side of body by a forked clip with four bolts in each, and with a hook on the side of body to hang chain on.

Plates.—Two plates 7 inches long, 1½ inch wide, $\frac{3}{4}$ inch thick, with two bolts in each, for the front wheels to strike against in turning the wagon.

Brake.—A saw or ratchet 23½ inches long, 1¾ inch wide, and $\frac{3}{8}$ inch thick, with arms 11 inches long, bolted on the right or off-hand side of the body, near the front end, with two $\frac{3}{8}$ -inch bolts at each end, with two iron plates on inside of side boards underneath the bolt heads; a guide of ½-inch round iron on the inside of lever, with the ends flattened and bolted to the ratchet arms, with one (1) $\frac{3}{8}$ -inch bolt at each end; a lever with jaws, for foot or hand use, 50 inches long, 1¾ inch wide, ½ inch thick, to retain this size two feet from the lower end, then taper to one (1) inch wide at top end, with a foot-rest bent outwards at right angles, 4½ inches, and bent back 1 inch; 5 inches from the top end, lever curved forward 9 inches from ratchet, ending below in an eye to receive $\frac{5}{8}$ -inch bolt welded to a forked plate 10 inches long, $\frac{3}{8}$ inch thick at shoulder, securely attached to the under side of bottom of body with three $\frac{3}{8}$ -inch bolts; connecting-rod 6 feet long, of ½-inch round iron, attached to front lever by a fork, 1¼ inch by ¼-inch iron, with bolt through both 11½ inches from lower end of lever; the back or rear end secured to back lever in like manner; back lever or roller-bar 1¾-inch round iron, 3 feet 5¼ inches long, to where end bent upward 22½ inches and flattened to 1½ inch wide, by ½ inch thick, with eye to attach connecting-rod, with two fulcrums each 4½ inches long, 1½ inch wide at roller, by $\frac{3}{4}$ inch thick, and 1½ inch by $\frac{3}{8}$ inch at lower end, with eye to attach the two fulcrum-rods, fulcrums 20 inches apart; a guide securely attached to roller-bar on the inside of each bracket; the roller brackets are formed of $\frac{7}{8}$ -inch round iron, with eyes through which the roller passes 6 inches in front of the hind axle, with clip fastening under the axle, and bolted to the under side of the hind hounds 20 inches in front of hind axle, with two $\frac{3}{8}$ -inch bolts in each, bolts 8½ inches apart; two fulcrum-rods 2 feet 6 inches long, $\frac{5}{8}$ -inch round iron, with a fork of 1¼ by ¼-inch iron, connecting fulcrum with a $\frac{3}{8}$ -inch bolt through each, and connecting brake-bar with nuts on rods at each side of the bar to take up the wear in the block and to adjust the bar to the proper purchase upon the wheels; brake-bar of oak or hickory, 5 feet 8 inches long, 5 inches wide at fulcrum-rods, and tapering to 3½ inches wide at each end, 1½ inch thick, with a clip at each end 5¼ inches long, 2 inches wide, $\frac{3}{8}$ inch thick, bent around 1½ inch on each side to receive the rub-blocks, which are to be 5 inches wide, 2½ inches thick, 11 inches long, the clips bolted to the bar with two $\frac{3}{8}$ -inch bolts each, one bar 3 feet 9½ inches long, 5½ inches wide, 2 inches thick, bolted to top of hounds with four $\frac{3}{8}$ -inch bolts, the bar tapering from hounds to 2½ inches wide at each end; the hangers which attach the hound-bar to the brake-bar, two links of ½-inch round iron, 8 inches long, with eye-bolts $\frac{3}{8}$ -inch round iron, the eye-bolts attached to hound-bar to extend down 3½ inches, flattened at lower end to 2½ inches wide, $\frac{3}{16}$ inch thick, forming a guide for connecting link, which is closed in the centre; the hook and link portable attachment of the hound-bar to the bed, a strap of iron 2 inches wide, ¼ inch thick, extending 4 inches on the under side of hound-bar, which eye-bolts pass through and hold in place, bent up 3 inches at end of bar, top end rounded with eye to receive links, two links at each end of hound-bar 2 inches long, $\frac{3}{8}$ -inch round iron; two straps 1½ inch wide, $\frac{3}{16}$ inch thick, 8 inches long, and bolted on each side of bed with two $\frac{3}{8}$ -inch bolts each, with a hook on lower end to receive connecting links.

Tongue.—The tongue to be 10 feet 6 inches long, 4 inches wide, 2¼ inches deep at front end of hounds, 1¾ inch wide, and 2½ inches deep at point of front end, and so arranged as to lift up the front end of it to hang within 2 feet 6 inches of the ground when the wagon is standing at rest on a level surface; the tongue-cap to be of $\frac{5}{8}$ -inch round iron, welded to side pieces 2 inches wide, $\frac{5}{8}$ inch thick, and 13 inches

long, bolted with three $\frac{5}{16}$ -inch bolts to the tongue; a plate $3\frac{1}{2}$ inches square nailed on top where double-tree rests; a hasp for double-tree 10 inches long, 2 inches wide, $\frac{1}{4}$ inch thick, fastened to tongue by a staple; double-tree hammer, or bolt, $8\frac{1}{2}$ inches long, of $\frac{3}{8}$ -inch round iron; staple in top of tongue for feed-box, 4 feet $1\frac{3}{8}$ inch from the centre of double-tree bolt; two rings 6 inches in front of feed-box staple.

Front hounds.—Front hounds 6 feet long, $2\frac{1}{4}$ inches deep, $3\frac{1}{2}$ inches wide over axle, and to retain that width to the back end of tongue; jaws of hounds 1 foot 6 inches long and $2\frac{1}{4}$ inches square at the front end, with a plate of iron $1\frac{3}{4}$ inch wide, $\frac{3}{8}$ inch thick, fastened on top of hounds over the back end of tongue with a $\frac{3}{8}$ -inch screw-bolt in each end, and a plate of iron of the same size turned up at each end 2 inches to clasp the front hounds together, and fastened on the under side and at the front end of hounds with a $\frac{3}{8}$ -inch screw-bolt through each hound and a $\frac{3}{8}$ -inch key-bolt through tongue and hounds, in the centre of jaws, to secure the tongue in the hounds; two plates 2 inches square, fastened with four nails on outside of jaws, at bolt-holes; a plate 1 foot 6 inches long, $2\frac{1}{4}$ inches wide, of No. 8 iron, secured on the inside of each jaw of hounds with two $\frac{1}{4}$ -inch countersunk bolts, and a plate of same dimensions on each side of tongue where the tongue and hounds rub together, secured with two rivets; a brace of $\frac{3}{8}$ -inch round iron to extend from under the front axle and take two bolts in front part of the hounds, the same brace to extend rearward to the back part of hounds and to be fastened with two bolts, one through slider and hounds and one through hounds 4 inches in front of slider; a brace or guard over sand-bolster of $\frac{1}{2}$ -inch square iron, 2 feet 4 inches long, with a bolt in each end to fasten it to the hounds; the opening between the jaws of hounds to receive the tongue $4\frac{7}{16}$ inches wide in front and $4\frac{3}{16}$ inches at the back part of jaws.

Sand-bolster.—The lower or sand-bolster 4 feet 6 inches long, $3\frac{1}{2}$ inches wide, 3 inches deep, fastened with four $\frac{1}{2}$ -inch screw-bolts through bolster, hounds, axle-stock, and braces.

Slide-bar.—Slider 4 feet 1 inch long, $1\frac{3}{4}$ inch wide, 2 inches deep, with a plate on top 4 feet long, $1\frac{1}{4}$ inch wide, $\frac{1}{4}$ inch thick, fastened at each end by a screw-bolt through the slider, hounds, and lower brace, and a rivet in the centre; the upper and lower bolsters each to have a plate 10 inches long, 3 inches wide, $\frac{3}{8}$ inch thick, with the corners drawn out and turned over on the sides of bolsters, with a nail in each corner and four countersunk nails through plates.

Front axle.—Axle-stock 4 feet $\frac{1}{2}$ inch long, $3\frac{1}{2}$ inches wide, $3\frac{1}{4}$ inches deep, fastened to axle with clips $1\frac{1}{4}$ inch wide, $\frac{1}{4}$ inch thick at ends, and a bolt through axle and stock at 6 inches each side of centre, and two hooks for stay-chains.

Front or loose bolster.—Loose bolster 4 feet 5 inches long, $3\frac{1}{2}$ inches wide, $4\frac{1}{2}$ inches deep in the middle and 3 inches deep at ends, with standards 15 inches high, $2\frac{3}{4}$ inches wide, 1 inch thick, with a tenon 2 inches wide into bolster, with a plate 6 inches long, 1 inch wide, $\frac{1}{2}$ inch thick, nailed to the inside edge; a strap $\frac{3}{8}$ inch wide, $\frac{1}{16}$ inch thick, on bolster under shoulder of standard, and turned down 2 inches on each side of bolster, with a rivet through bolster; a plate 2 inches wide, $\frac{1}{16}$ inch thick, on bolster close to inside of standard, turned down 2 inches on each side of bolster, with two nails in each side and one nail in top; a $\frac{3}{8}$ -inch bolt through bolster and standard; two hooks in rear side of bolster, 14 inches each side of centre, and clinched on front side, to receive two chains 22 inches long, bolted to each side of the coupling-pole 18 inches from king-bolt; width between standards 3 feet $6\frac{1}{2}$ inches, to receive body 3 feet 6 inches wide, outside.

Hind hounds.—Hind hounds 4 feet 11 inches long, $2\frac{1}{4}$ inches deep, $2\frac{3}{4}$ inches wide back, and $2\frac{1}{2}$ inches wide front; jaws 10 inches long and 4 inches wide at the end where they rest on coupling-pole.

Hind bolster.—Hind bolster 4 feet 5 inches long, $3\frac{1}{2}$ inches wide, 3 inches deep, with standards and irons the same as on the loose bolster, fastened with four $\frac{1}{2}$ -inch bolts through bolster, hounds, axle-stocks, and braces under axle; a brace under hind hounds and axle of $\frac{3}{8}$ -inch round iron, and bolted to hounds 1 foot 8 inches forward of axle.

Hind axle-stock.—Axle-stock 4 feet $\frac{1}{2}$ inch long, $3\frac{1}{2}$ inches wide, $3\frac{1}{4}$ inches deep, fastened to axle with clips $1\frac{1}{4}$ inch wide, $\frac{1}{4}$ inch thick at the ends, and with a bolt

through axle and stock 6 inches each side of centre ; jaws of hind hounds fastened together with two bolts through jaws, and a band of $1\frac{1}{2}$ -inch No. 10 iron at the end of jaw ; a plate 9 inches long, $3\frac{1}{2}$ inches wide, of No. 10 iron, on top of jaw ; a loose coupling-band, $1\frac{1}{4}$ inch wide, $\frac{1}{4}$ inch thick, around jaws and coupling-pole, with a $\frac{5}{8}$ -inch bolt, $7\frac{1}{2}$ inches long, through bands, hounds, and coupling-pole.

Coupling-pole.—Coupling-pole (loose) 8 feet 9 inches long, $3\frac{1}{2}$ inches wide, $2\frac{3}{8}$ inches deep, with a rivet through front end ; a plate 5 inches long, $2\frac{1}{2}$ inches wide, $\frac{3}{16}$ inch thick, nailed on top at king-bolt with six countersunk nails ; a rub-plate 8 inches long, $1\frac{1}{4}$ inch wide, $\frac{1}{4}$ inch thick, fastened with two rivets on under side, over slider.

Double-tree.—Double-tree 3 feet 10 inches long, 4 inches wide, $1\frac{1}{2}$ inch thick, with two clips for single-tree and two for stay-chains.

Single-tree.—Single-trees 2 feet 8 inches long, $2\frac{3}{4}$ inches wide, $1\frac{1}{2}$ inch thick, with clip and ring on each end, and a clip in centre with an open ring to attach to double-tree ; a plate on under side of double-tree, 6 inches long, 3 inches wide, $\frac{1}{8}$ inch thick, and one on top 2 inches square.

Wheels.—Front wheels 3 feet 8 inches, and hind wheels 4 feet 8 inches high.

Spokes.—Sixteen spokes 2 inches wide and 2 inches thick at hub, and 2 inches wide and $1\frac{1}{2}$ inch thick at the felloe.

Felloes.—Eight felloes 2 inches wide, $2\frac{3}{8}$ inches deep.

Hubs.—Hubs 9 inches diameter at flanges, $3\frac{1}{2}$ inches diameter at front, 4 inches diameter at back end, 12 inches long, including sand-band 1 inch wide, $\frac{1}{4}$ inch thick, and a band on front $2\frac{1}{4}$ inches wide, $\frac{1}{4}$ inch thick ; spokes and felloes pressed together (by the Archibald press or other process) and secured with eight $\frac{9}{16}$ -inch screw-bolts through flanges and spokes ; box 10 inches long, bored out to a diameter of 2 inches at back or shoulder end and $1\frac{1}{32}$ inch at front end, or to taper $\frac{1}{4}$ inch to the foot in length.

Tires.—Tires 2 inches wide, $\frac{1}{2}$ inch thick, fastened with eight screw-bolts, one in each felloe. Spokes and felloes of white oak, thoroughly seasoned ; hub of cast-iron with cast-iron bands on each end, the front band a screw-band.

Axles.—Axles, of the best quality American refined hammered iron, 2 inches square at shoulder, tapering down to $1\frac{1}{8}$ inch in the middle, with a $\frac{7}{8}$ -inch king-bolt hole in front axle ; arms 10 inches long between shoulder and nut, 2 inches diameter at shoulder, and the taper $\frac{1}{4}$ inch to 1 foot in length ; an $\frac{1}{8}$ -inch groove the whole length of arm on top to retain the oil ; a right- and left-hand thread on end of arms, to be U.S. standard, $1\frac{1}{4}$ -inch V-thread, seven threads to the inch, with a $1\frac{3}{4}$ -inch six-sided nut or burr $1\frac{1}{4}$ inch thick, with flange-collar $2\frac{1}{2}$ inches in diameter. Axles to be 4 feet $2\frac{1}{2}$ inches long from outside of one shoulder-washer to the outside of the other, so as to track 5 feet from centre to centre of wheels. Two (2) extra nuts or burrs of the kind prescribed herein for ends of axle-arms to be furnished with each wagon.

Feed-box.—Feed-box, sides of pine, 4 feet long ; the bottom and ends of oak ; sides 8 inches deep ; box $7\frac{1}{2}$ inches wide at bottom, $10\frac{1}{2}$ inches wide at top, outside, well ironed with a band of hoop-iron around the top, one around each end, and three between the ends, with strong and suitable irons to fasten on the tongue when feeding.

Stay-chains.—Stay-chains to connect front axle to double-tree.

All the work to be neatly chamfered and rounded. The outside of body and feed-box to have three good coats of white lead, coloured to a dark leaden blue ; the inside to have two good coats of Venetian red paint ; the running-gear and wheels to have three good coats of Venetian red and vermilion mixed half and half ; all irons and chains to be painted black.

Each side of body of wagon to be lettered U.S. and numbered ; all other parts to be stamped U.S.

The body and running-gear to be so put together that they can be taken apart for shipment.

An axle-wrench, tar-pot, and extra king-bolt, two extra nuts for axles, a lead-bar, with stretcher, chains, and single-trees attached, to be furnished with each wagon.

The links of tongue, stay, and feed-box chains to be of $\frac{1}{4}$ -inch iron, lock-chains of $\frac{5}{16}$ -inch iron, links not over $2\frac{1}{4}$ inches long.

Distance from the centre of king-bolt hole to centre of back axle 5 feet $9\frac{1}{2}$ inches,

and from centre of king-bolt hole to the centre of bolt in jaw of hind hounds 1 foot 10 inches; distance from the centre of hind axle to centre of bolt in jaw of hind hounds 3 feet 11½ inches, and from the centre of king-bolt to centre of slider 2 feet 2½ inches; distance between the inside of front and high standards 5 feet 8½ inches, to receive the body, which is 5 feet 8 inches from outside to outside of cleats of sides.

Weight of wagon, about 1,555 pounds complete for four horses or mules.

HARNESS.

Specification of the Size, &c., for Four-Mule U.S. Army Wagon.

Wheel.

Precisely the same as for six-mule U.S. wagon.

Lead.

Two collars. Two pairs hames. Two bridles. Two neck-straps and chains. Two belly-bands. Two pairs chain-pipes. Two pairs trace-chains. One bearing-chain. Two cruppers and hip-straps. Two back-bands. One martingale. Two coupling-straps. One check-rein. One jockey-stick, the same as for the lead harness of the six-mule wagon.

One lead-line, 21 feet long, 1 inch wide, with buckle at one end and an 8-inch loop at the other.

One lead-line ring, 3 inches in diameter, to be attached by a leather strap 12 inches long, 1 inch wide, with buckle to the back-strap over hip-strap of the near lead mule; the lead-line to pass through this 3-inch ring.

One whip.—"Black-snake," 5 feet 6 inches long, 1½ inch diameter at butt.

The whole, except jockey-stick, to be packed in a box 18 inches wide, 17 inches deep, and 34 inches long, of 1-inch stuff, coopered with wood hoops or iron, as may be required.

Wednesday, March 14, 1883.

LIEUT.-GENERAL SIR C. P. BEAUCHAMP WALKER, K.C.B.
(Colonel Queen's Bays), Chairman of the Council, in the Chair.

THE YEOMANRY CAVALRY CONSIDERED AS AN
AUXILIARY AND AS A RESERVE FORCE.

By Major C. G. EDWARDS, 2nd W.Y.Y. Cavalry.

I do not propose to trouble you with more than a very brief outline of the history of the Yeomanry, but, as I hope to demonstrate the possible value of the force in the future, it is necessary to show that it has been of some service to the country in the past.

The Yeomanry is undoubtedly a force of very respectable antiquity; up to the middle of the last century it stood upon a footing analogous to that of the Militia, and indeed the terms "Yeomanry" and "Horse Militia," were synonymous. In 1793 it was reorganized upon the system of the Volunteers of that period, and the oldest regiments of Yeomanry now in existence were formed at that time. In 1796 a very large force was raised in Ireland, the conduct of which it is interesting to glance at, in view of the existing condition of affairs in that country. In the autumn of that year the Government proposed to all loyal subjects in Ireland to embody themselves as Yeomen, in corps similar to those existing in England, and subject to the control of Government. The proposal, though vehemently opposed by the Roman Catholics throughout the country, and even the Presbyterians of Belfast, was embraced with alacrity; the first estimate laid before Parliament for 20,000 men was filled up immediately; in the course of six months it rose to 37,000, and during the Rebellion the Yeomanry force exceeded 50,000, "all of whom," says the Report of the Secret Committee of 1798, p. 5, "were to be depended upon."

This was doubtless a hazardous experiment, after the experience the Government had had with the Volunteers, and some valuable lessons may be deduced from the behaviour of the two forces, recruited, as they necessarily were, from different classes of the community. The Volunteers had become a most dangerous political power, and, says Sir Richard Musgrave, in his *Memoirs of the Rebellion*, "popularity among this order became a certain step to preferment." This was because the Government, involved in war with France, Spain, and America, and compelled to denude Ireland of regular troops, allowed themselves to be completely intimidated by the Volunteers. Delegates from the force actually assembled at Dublin and propounded reforms of Parliament and other political measures, whilst a grand convention of Volunteers discussed the reform of the Constitution.

The confidence, however, which the authorities reposed in the Yeomanry was not misplaced; the writer I have already quoted goes so far as to say that "they saved the kingdom from impending destruction." During the Rebellion the force was on duty throughout the country; portions of it took part in the so-called battles of Antrim, Saintfield, and other engagements, and in the important affair of Vinegar Hill, when General Lake defeated the French and rebel forces with a loss of 13 guns. Under General Knox, who marched to Tyrone with some 1,500 Yeomanry, they prevented the rebels of county Derry from rising.

In 1807 the Yeomanry were on duty for some months, and it was not until June of that year that the Duke of Wellington was able, writing to Sir Edward Littledale, to say, "I think you may now venture to discontinue the permanent duty of the Yeomanry in Sligo." The remarks of that great leader upon the force are interesting. In May, 1807, he writes to Lord Hawkesbury:

"I have a very good opinion of the Yeomanry of Ireland. They are disciplined as well as corps of this description can be expected to be, and I doubt very much the policy of attempting to make any improvement in their discipline. I think that both in England and Ireland we have attempted too much in the way of teaching 'parade discipline' to the Yeomanry. . . . The parade discipline which they receive in large bodies would be entirely useless—nay, would embarrass them—when they are called upon to act as light troops."

Possibly the Duke would, under the altered conditions of to-day, modify his views upon the subject of discipline.

Upon the restoration of order in Ireland, the Yeomanry were disbanded, but in England their services were in constant requisition. Until the railway system had reached some degree of perfection, communications in this country were difficult, military stations were few and far between, the police force was an institution of the future, great dissatisfaction existed amongst the lower orders, and riots were of frequent occurrence. Many of these disturbances were of a most serious character, such, for example, as the agricultural, mining, and manufacturing riots, the "Corn Law," the "Plug," the "Chartists," the "Bristol," "Nailers," "Blanketers," and similar outbreaks. The Yeomanry were, in consequence, constantly called out, one regiment, the Staffordshire, being on permanent duty six months in one year. Without entering into details, it will be sufficient to say that the force received the thanks of Parliament on more than one occasion, that it was the object of a congratulatory General Order by the Duke of Wellington, and was frequently thanked by the local authorities. The last occasion upon which any portion of it was called out in aid of the civil power was in 1865.

At one period the establishment of the English branch of the force was over 40,000 men, but, in the interests of economy, it was for many years persistently reduced; of late years, depression in agriculture and trade has saved the authorities the trouble of making such reductions, and the present establishment is only 14,458.

I trust that this sketch will have shown that the antecedents of the Yeomanry would justify any determined efforts to increase their efficiency as a military institution.

It was rumoured not long ago that a fresh attempt to reorganize the force was in contemplation. It is to be hoped that the labours of any Committee which may be assembled for the purpose may be less barren of results than those of their predecessors. Their efforts were abortive, chiefly from the pre-announced determination of the authorities to sanction no suggestions which would involve any addition to the Yeomanry vote, but in no slight degree from a failure to recognize the true character of the force with which they were dealing.

I would ask permission to point out what is the true rôle of the Yeomanry, to suggest the advisability of developing and turning to greater advantage the valuable military qualities which undoubtedly exist in the force, and to show that such a development would amply justify a slight temporary addition to the Yeomanry estimates.

It will, in the first place, be logical to indicate the nature of these qualities, always premising that the components of a force, which is essentially territorial, must have characteristics peculiar to different localities. Regiments, for instance, which are raised in manufacturing or mining districts will not possess qualities which are to be found in purely agricultural regiments, and *vice versâ*. Thus the former may be more intelligent in drill, and better mounted than the latter, but will not, as a body, be distinguished by those sporting instincts which render their more bucolic comrades so valuable; at the same time, in some regiments an equal proportion of both classes may be found.

With these reservations, it may be said that the men of the force are hardy and active, the age of privates varying from nineteen to thirty, of non-commissioned officers from twenty-five to forty. Taken as a whole they are good riders, and in every regiment there are splendid horsemen, capable of riding anything anywhere. Accustomed to an out-of-door life they are thoroughly inured to the vicissitudes of our English climate, whilst their daily pursuits give them the power, and frequently the habit, of noticing and forming deductions from natural and physical signs, an accomplishment which no amount of drill or military training can inculcate, which only natural sportsmen and men accustomed to a country life can attain, and which is simply invaluable to the light cavalry soldier. They are fair rifle shots, though, as a rule, their opportunities of ball practice are infrequent; their proficiency, where it exists, is perhaps due to the fact that they are accustomed to use and carry a gun, a habit which recent legislation will not tend to discourage. With proper encouragement a good deal might be done in this direction.

In addition to being fairly good shots and riders, a most desirable combination, the men possess a valuable knowledge of country. Every regiment may be depended upon to furnish guides for any part of its district—men acquainted with every short cut, whether by fence, gap, or gateway, and able to give information obtainable from neither map nor survey, but without which movements in the enclosed parts of England would be attended with extreme difficulty.

The discipline of the Yeomanry is very good; it is maintained by the self-respect of the men, by *esprit de corps* and affection for the Officers. In most cases the men now serving are sons or nephews of a former generation of Yeomen, who have ridden together in corresponding ranks in the same regiment. In many instances the families of Officers and men have been united for generations in the relationship of landlord and tenant, and hence a feeling exists between the different ranks which has no exact parallel in any other branch of our national forces, and which on active service would develop to such an extent as to become a valuable factor in the utility of the Yeomanry.

The men are, as a whole, well educated: all can read and write, a matter of no small importance for reconnoiters; a fair proportion can read and understand a map.

A word as to the horses of the force. Most regiments are well mounted, some admirably so, but they all possess this characteristic in common—the horses, like the men, are essentially local. The advantage of this for the discharge of such duties as the Yeomanry ought to perform is obvious; the horses of regular cavalry cannot be too level: they should be like a pack of hounds; but the physical features of this country are so diversified that, if the Yeomanry are to be able to get across it, their horses must come from the districts they represent. If any one questions this, let him take a Leicestershire horse amongst the banks and coombes of Devonshire, or a Devonshire horse into the pastures and oxers of the Midlands, or let him try to ride either of them over the moorlands and stone walls of Yorkshire or Wales.

To summarize, then, the good qualities of the Yeomanry, it may be said that they are, as a whole, active men in the prime of life, well educated, good riders and fair shots; that they are intimately acquainted with their own districts, and naturally possessed of certain instincts most valuable to light cavalry and most difficult to teach; that they are sufficiently well mounted to ride over their own country, and that an excellent feeling pervades all ranks.

It will not be denied that these are valuable military qualities, furnishing admirable material upon which to work; but if we are asked whether they are turned to the utmost advantage, the reply cannot but be in the negative. The fault, however, lies not with the men, but with the system under which they are trained and equipped; they have been made, though it must cause a pang to say so, too much like regular cavalry: the authorities have aimed at a standard which, save under exceptional circumstances, cannot be attained, and which is really not desirable.

It is this which has subjected the Yeomanry to so many criticisms; for men have asked, and not without reason, how cavalry can be produced by an annual training of a few days. It will be well to ascertain, in the first place, what amount of time is available for training; we shall then be in a better position to decide how it may be best employed. Taking three regiments haphazard, one from the North, one from the Midlands, and a third from the extreme South of England, the drills performed in 1882 were as follows. In the first case, the average number attended by each man were 12·3 dismounted,

5.1 mounted. Three of these mounted drills were complete days, the men forming a royal escort, and being on duty twelve hours each day; in addition to the above every man was out for ten days' permanent duty.

The Midland regiment had an average per man of $3\frac{1}{4}$ mounted, $6\frac{1}{2}$ dismounted drills, exclusive of eight days' permanent duty. The third regiment had, per man, 3 mounted and 13 dismounted drills, exclusive of eight days' permanent duty.

It should be observed that most of these drills represent, not, as in the case of the Volunteers, an hour or two at the end of a day's work, but a complete day spared from the duties or business of life; a greater sacrifice of time cannot therefore be expected from the Yeomanry, but is this sufficient to train them as cavalry?

What are the functions of cavalry? They may be broadly classed under two heads—the execution of the charge or shock in battle, and the performance of detached duties. For the first regular cavalry alone can be relied upon, and it is only repeating a truism to say that for such duty any but the best cavalry are worthless: for this reason, if for no other, that a charge, to be satisfactory, against cavalry at any rate, must be executed simultaneously by every unit of the attacking force. To effect this the horses must be so perfectly level in speed, weight, endurance, and training, that even after, if necessary, a long gallop, the actual shock may be delivered with the precision of a machine.

Now under the existing system, it is obviously impossible that Yeomanry can ever be mounted in this way, nor, for the reasons already given, would it be desirable. But the remaining functions of cavalry, including scouting, dismounted service, &c., are, in their proper place, equally important, and for the discharge of these the Yeomanry are specially qualified. Let, then, the notion be discarded that, save under exceptional circumstances, to which allusion shall be made, the Yeomanry can ever be required to charge. Let them discard with it portions of the existing dress and equipment, which are of doubtful value, even for regular cavalry, and let them be supplied with a uniform, weapons, and equipment which, whilst interfering in no way with the discharge of light cavalry detached duties, would render them twice as valuable a force as they are at present.

The change would amount to this, that instead of being trained, dressed, and equipped purely as regular cavalry, they should be trained and armed, &c., as Mounted Rifles, or, if the term is repugnant to the traditions of the force, as Dragoons, in the original sense of the word.

And here let it be understood that conversion into Mounted Infantry is not advocated. The latter should be perfectly trained infantry soldiers, temporarily mounted for strategical or tactical purposes, and when once dismounted able to hold their own against any other infantry. But the time at the disposal of Yeomanry or Volunteers is far too limited to produce either good cavalry or infantry, and it would therefore be as useless as it would be undesirable to attempt to convert the Yeoman into a foot soldier. On the other hand, the natural

qualities of the Yeomanry recruit present him to the drill sergeant already half trained as a mounted rifleman. He can ride, he has an idea of shooting, and if only the notion is dismissed of making him into a trained trooper or a well-drilled foot soldier, it will be found that the time he so cheerfully sacrifices is sufficient to make him into a most valuable auxiliary.

The Yeomanry might take consolation for their conversion from the thought that, from no other class, from no other branch of our regular army, and from neither Militia nor Volunteers, could the material be found from which such a force could be raised.

Tactics.—The Yeomanry, when not detailed for special duties in connection with other troops, would be well adapted for “partisan warfare.” Indeed, they are, in “constitution,” &c., not unlike the horsemen who, under Jackson, Morgan, Stuart, Pleasanton, Mosby, and others, performed such signal service in the American War of Secession. Sir Lumley Graham, after reciting the numerous campaigns which, in the history of war, have been influenced by this kind of warfare, says:—

“Partisan warfare is likely to be more largely practised, and to produce greater results than ever in the next great European conflict. . . . The only way of stopping the reconnaissance of a strong force of cavalry, unsupported by infantry, is to meet it with little parties of infantry too mobile to be caught.”

Or, which would amount to the same thing, Mounted Rifles.

The tactics of the Yeomanry should, therefore, be influenced by their suitability for this purpose. They should be, when in action, of the simplest character, based upon one all-absorbing idea—an unremitting endeavour to harass and annoy the enemy. Their leader must be ceaselessly on the watch for opportunities of effecting this object. Whether his opponent is marching or manœuvring, advancing or retiring, a position must be taken up from which fire may be opened, at once unexpected, galling, and effective. This fire must be maintained until an attempt is made to dislodge him, when he must mount his men and gallop off to a fresh position, only to renew similar tactics. In the absence of definite orders he will always endeavour to enfilade the enemy. In changing position he may move at full speed, for his horses will not at the end of their gallop be called upon for a greater effort, as in the case of a charge by regular cavalry, but will have an opportunity of getting their wind. The support to the dismounted men must follow at a more steady space for obvious reasons.

In the enclosed portions of England a force able to ride across country, armed with a good rifle, and employing such tactics, would be as unassailable by regular cavalry as by infantry. Being, moreover, always under cover from view, when halted, and being constantly on the move, it would be a waste of time for guns to attack them.

Drill.—The existing system of drill, with one or two exceptions, should not be interfered with. For Mounted Rifles as for regular cavalry, simplicity is the point to be aimed at, and for this quality the so-called non-pivot system is as near perfection as possible. Perhaps

changes of front from the halt would not be often required, but changes of position, formation of line and column from one or the other, and indeed most of the field movements laid down in the regulations, would be useful for Dragoons or Mounted Rifles. It has been stated that all movements in close formation should be avoided by Yeomanry; but whilst it is essential that Mounted Rifles should be as mobile as possible, the necessity of obtaining shelter for led horses, or of the whole force on frequent occasions, renders all movements of value which enable a concentration of units to be effected.

It seems very necessary that mounted troops should always work in two lines, the rear line, or any unit of it, being always regarded as the support of the line in front. This might easily be done in the Yeomanry by working in single rank, which would not meet with the difficulties which it would encounter in the regular cavalry, there being at present no great dearth of Officers in the force.

The day will doubtless arrive when by all cavalry double rank will be considered as antiquated a formation as the triple rank of the old Dragoons, or the four and six ranks of their predecessors. It is contrary to the spirit of modern tactics, it is on active service generally abandoned by us in consequence of the weakness of our squadrons, and it has been condemned as false in principle by such leaders as the "Iron Duke," Sir Harry Vivian, General Bacon, and many others.

For Yeomanry, as for all partially trained horsemen, the advantages of the rank entire formation are very great. For purposes of parade appearances might be saved by closing up the lines to a certain distance; but if the Yeomanry are to be a valuable force, considerations of this kind must not be allowed to stand in the way of really practical innovations.

As a matter of fact, movements by squadron columns, so favoured by the Germans, and destined apparently to be the groundwork of our future field days, would, if practised in rank entire, give all the advantages of the second line with the appearance of double rank.

The ultimate object of any formation of line, or advance in line, should not be, as at present, the attack, but dismounted service. I know how repugnant this idea will be to many of my brother Officers, but if ever the Yeomanry have to form line in the presence of an enemy it will be not to charge but to fire. To all dismounted parties there must of course be some mounted support, and this should at drill be occasionally gratified with a gallop; but the Yeomanry, if intended to be Dragoons or Mounted Rifles, and not cavalry *pur et simple*, should understand that, as a rule, the object of their Commanding Officer, in changing position, suddenly forming line or advancing, will be to gain cover, under which to dismount and pour a hot fire into the enemy. All those movements, then, which hitherto have been succeeded by a wild charge, should be followed by an order to dismount. Some ammunition will be blazed away, but it will not be wasted, the horses will not be fatigued, the men will get handy with their weapons and quick in jumping on and off their horses, and some practical results will be attained. A good deal of interest might be raised in regiments in such drill by giving prizes to the troop that could most rapidly come into action and "limber up" again.

In addition to ordinary field movements, the men should be drilled to advance from a flank or flanks of large or small bodies and extend rapidly. Such a drill would be essential in any attempt to get across country, for no troops in the world could ride in line at ordinary intervals over any natural fence.

The main question, with regard to dismounted service, which has exercised the minds of cavalry leaders is, How many rifles can be brought into action? Under the system laid down by our cavalry regulations, a squadron which has to furnish its own support can only dismount one-fourth of its men. Thus, out of 48 file, 24 being retained as support, only 12 could fire, or 24 men out of 96, a very small proportion.

Assuming that the whole squadron was available to dismount, 48 rifles might be brought into action. In some armies one horseholder is allowed to every three horses on each side of him. The plan of holding four horses has also been tried, the holder remaining mounted. But in the case of Mounted Rifles, whose fire would be delivered from a comparatively unassailable position, behind the fences of an enclosed country, an effort should be made to place more rifles in line. To link horses would at once simplify matters, but when a number of horses are linked it is a very risky, besides being a comparatively slow process; there seems, however, no reason why a modification of this method should not be adopted.

I would suggest that whenever it is proposed to dismount any body of men, it should first be formed into column, either of fours or half troops, the support of course remaining in line. The horses of the dismounted men being immediately under cover would not be likely to be required to advance straight to their front. The whole, not merely the odd or even numbers, would then dismount, the units of the column (fours or half troops) passing sufficiently. The different units would then link horses in the manner described below, two men being left with each four, *i.e.*, one to every four horses, four with each half troop, or one man to every six horses, whether front or rear rank, the remainder forming to the front or flank of the column as required.

This would give, in the case of a squadron of 48 file, in column of fours, 72; in columns of half troops, 80 rifles, instead of as at present 48.

To render this feasible, I would suggest that the horses should be linked upon the following principle. Upon each side of the bridles there should be a short cheek strap attached at one end to the top ring of the bridoon, and at the other by an ordinary swivel to a ring or loop just below the headband. On dismounting, every man, except the outer flank troopers, unhooks the off strap of his own horse's bridle, and the near strap of his neighbour's, and connects them by the two swivels. The length of each of these straps with swivels is 12 inches, the weight slightly less than $1\frac{1}{2}$ oz. The horses, when linked, stand, as if on pillar reins, at about the usual interval. The plan has the advantage of simplicity, and, so long as no more than the four or six horses watched by one man are connected, does not present the numerous difficulties and dangers of linking in the ordinary way. It

can, moreover, be done far more rapidly, for the action of connecting the horses is momentary. It is an advantage to dismount all the men, and not to leave the horseholders stuck up as marks to show where the led horses are. If it becomes absolutely necessary to move them, horses will always cling together, and by mounting the central horse of his squad, and seizing the reins of the outer horses, a man can keep them together. It should, however, rarely be necessary to hurry up the led horses. The commander of Mounted Rifles should never allow the enemy to get so near him as to jeopardize his dismounted men.

To render this dismounted service more simple, there should be in Yeomanry no such thing as "fours," in the existing sense of eight men abreast. The term should be employed to mean four men only. The word section might then be reserved for the fourth part of a squadron, or half troop, just as in the infantry it represent a fourth of a company. Such a distribution is employed in the Austrian, German, French, and Italian cavalries, and indeed existed with us, under the form of division, but a few years ago. It would represent the "peloton" and "Zug" of our continental neighbours, and one has only to study the daily proceedings of squadrons on active service in the campaigns of 1866 or 1870-71, to recognize the hourly demand which exists for such an organization.

Each of these sections should be led, as in the Austrian cavalry, by an Officer; it is far better to have a permanent commander of a half troop, than to extemporize one when occasion arises. If working in double rank, the junior section leaders of each troop would ride in rear, as a serrefile. If in single rank, whether in one or two lines, in front. This arrangement would not increase the existing establishment of Officers, but would distribute them more effectively.

I would propose a further innovation. The misfortunes of the Austrian army, in 1866, have rendered us too oblivious of the brilliant services performed by their cavalry at that period; but we may imitate them with advantage in many respects. To them we owe, in reality, our emancipation from the cumbrous drill of ten years ago, and the Yeomanry might take yet one other lesson from them. In all field movements, at any rate, let them ride like the Austrian cavalry with both hands, and, if they are armed with that weapon, with undrawn swords. In riding a partially trained horse it is, as every one knows, a great advantage to have the full use of both hands, and if the horse is to be ridden across country it is often essential. The mouth of the animal will, moreover, be improved by the introduction of such a system, and Yeomen will find it more easy to drill correctly. As to riding with swords, the Yeomanry, as Mounted Rifles or Dragoons, should seldom have to use them, and, save when supporting dismounted men or performing parade movements, they should never be drawn. De Brack lays great stress on the importance of not drawing swords until the moment of charging. He says: "If a line draw swords before moving, it betrays their object prematurely to the enemy." Again:—

"The soldier who has been carrying his sword drawn for a long time loses the freshness of his respect and enthusiasm for his

weapon; but if this same man lays hold of his weapon at a spirited order from his chief at the very moment when he is to make use of it, he grasps it with more force, more eagerness, and strikes with it more energetically."

This opinion was corroborated by the experience of Mosby, Gilmor, and other leaders in the American Civil War.

Before leaving this branch of my subject I must strongly dissent from the opinion occasionally expressed, that the training of the Yeomanry should be confined to reconnoitring and outpost work. It doubtless seems an anomaly that a body of troops whose special rôle is supposed to be detached duty should in their training almost entirely neglect it; but the fact is, that before we can utilize any natural aptitude which men may possess for reconnaissance, &c., we must be able to move them with facility in regular formations. But this can only just be obtained in the Yeomanry by working hard at field and parade movements during the training, and that period is so short that the time required for any practical instruction in detached duty cannot be spared. If, then, any attempt is made to substitute a course of reconnaissance or outpost duty for the usual drill, it will be found that the men will gain little information that they did not already possess, and will deteriorate greatly in value as a military body.

But whilst permanent duty should be mainly devoted to drill, every opportunity should be taken during the winter and spring of getting small parties of men together for theoretical and practical instruction in reconnoitring, &c., and in order that troop Officers may possess the necessary qualifications, they should be required to go through a course at Aldershot or elsewhere.

Equipment.—The Yeoman of the future must not look upon his sword, but his rifle, as his chief weapon. Whether this should be the long or short rifle is a moot point. Advocates of the latter say that the long rifle is, under any circumstances, a clumsy weapon to carry mounted, awkward both for man and horse; and if the Yeomanry can be armed with carbines, shooting accurately up to 800 or 900 yards, there does not seem to be much necessity for anything better. It may be said, in support of this theory, that in an enclosed country it is seldom that troops are visible at a greater range, and any weapon would be of little use at long distances, except in the hands of picked shots.

On the other hand, the long rifle has stood the severest tests on active service. The mounted infantry commanded so ably by Major Barrow in South Africa carried it, and, he informs me, experienced no difficulty, or even awkwardness, from the length of the weapon in mounting and dismounting. It was carried in the Namaqua buckets, so that the men were not injured as they are apt to be by a rifle slung over the shoulder. The bucket did not gall the horses' sides or produce sore backs.

In Egypt the long rifle was used with equally satisfactory results.

With reference to the way in which the rifle was carried in this and in the recent campaign in Afghanistan, Lord Melgund, who served with distinction in both, has given me some very interesting

information. In Egypt, he says, both the long and short Martini-Henry were carried without bucket or sling. The mounted infantry always carried them in the hand. I cannot conceive how in bad weather, or in a protracted campaign, such a system could be possible, and hope it will never be adopted for Yeomanry; the circumstances which rendered it practicable in Egypt must have been exceptional, and possibly the mounted infantry did not carry buckets because there were no buckets for them. In Afghanistan, the same Officer tells me, the carbine was carried as by our regular cavalry, in a bucket, but a great many carbines were lost from horses falling upon them before they could be disengaged. It was suggested that the men should, the moment they came under fire, draw their carbines; this would be awkward for regular cavalry, who may be called upon to charge at any moment, but for such troops as I am endeavouring to describe would seem to meet the difficulty.

But if the force is to have a new rifle, and this is the first step that must be taken if their efficiency is to be materially increased, let them have at once a repeating or magazine rifle. These must be the weapons of the future, and the army that is first supplied with them will have a tremendous advantage over its adversary. They are already used in the Swedish, French, and other navies, and, experimentally, in our own, and are being gradually introduced into continental armies. The theory that such weapons caused waste of ammunition has been disproved by practice; they proved of startling efficacy in the American War, and the Circassian cavalry, armed with the Winchester or Winchester-Henry carbine, performed some remarkable service in the Russo-Turkish campaign. If, however, the authorities will not entertain the question, perhaps the principle of the new point-blank rifle might be applied to the Martini-Henry carbine, or rifle, and issued to the Yeomanry.

The sword, if worn at all, should not be carried as at present. The Dragoon ought to be as active on foot as any rifleman, but no man can run with a sword, 40 inches long, and broad in proportion, now sticking in front, now catching behind, and lastly getting between his legs. Even when hooked up, the long slings are in the way and the sabretâche is simply a nuisance; the fastest runner in the country would be heavily handicapped if he had to run with a bunch of slings in one hand, a rifle in the other, and a sabretâche dangling against his legs. If Yeomanry are to fight effectively on foot, the sabretâche must be abolished; it is not wanted for any papers, as they can be carried with equal safety in the wallets. The sword ought to be attached to the saddle; if it is awkward to reach in the usual place let it be fixed on the near side, *in front of* the saddle, like a horn. This will doubtless look hideous, but it will be practical, and after all such things are merely matters of fashion: twenty years ago the tunic was considered an abomination.

The sword, however, is really of little use for Yeomanry; like the lance, it is a feeble weapon unless wielded with the utmost skill; the casualties caused by it in the Franco-German War were absurdly small; from a Return issued, in 1876, by the German medical staff it

appeared that of 65,160 killed and wounded on their side, only *sic* were killed by the sword, 212 wounded, though something like 40,000 cavalry were engaged, and had some heavy fighting. The circumstances in which the sword was recently used in Egypt were quite exceptional.

A mounted man, however, must have some other weapon than his carbine; on service the Yeomanry should undoubtedly be armed with a rifle and revolver; the value of such equipment for such troops was proved in a thousand instances during the War of Secession, but unless the authorities can supply the whole force, the sword must be retained.

I would urge very strongly that in every troop of Yeomanry, four, or at least two men should be told off as pioneers; they should be equipped with Major Wallace's spade, which could hang on the near side behind the saddle. On service, in crossing the country, for making and filling up gaps, creating obstacles, &c., these men would be invaluable. The cost of the spade is about 6s., the bucket about 7s.: this could be defrayed from regimental contingent funds.

Lastly, a couple or more of Morris's aiming tubes should be issued to the headquarters of every troop, and the men encouraged to purchase them for private practice.

Dress.—The question of dress must now be approached. There are no more handsome uniforms in the British army than in the Yeomanry Cavalry, and it is with a pang of regret that I suggest that many of them should be consigned to the limbo to which brass epaulettes, high stocks, monstrous headgears, and other relics of past tailordom have departed. The undress for foot parade, stable duty, &c., is, as a rule, neat and practical, and might well be retained by regiments—and, as a link with old times, Officers might retain their present mess dress—but, as a rule, the field day or review order of Yeomanry is quite inappropriate for mounted riflemen. I should like to see one uniform adopted for the whole force: the advantage of this would be very great if only for purposes of concentration. Some months ago, when it was proposed to assemble a representative regiment at Aldershot, an insuperable difficulty arose in the diversity of uniform which existed in the Yeomanry. For mounted duties they should have a low helmet, or short busby; a dark blue uniform, sufficiently loose at the arms and waist; dark breeches and "Field" boots; pouch and waist-belts of white leather—dark leather does not help to conceal a man, and always gives a dirty appearance. There should be no sword-belt; the ammunition should be carried as at present; the cartridge-belt worn by the irregulars in South Africa is not suitable for this variable climate. The pouch at present worn by Officers in both regular and auxiliary cavalry is useless: it will not even carry cigars satisfactorily; it should be replaced by a case for binoculars similar to those worn by the Staff, and should be carried not only by Officers, but by serjeant-majors and sergeants.

Whatever alteration may be made in the uniform of the force, care should be taken to render it attractive. Men cannot be expected to take any pride in themselves if they are clad in an ugly dress. The

Hussar tunic, or Horse Artillery jacket, already worn by some regiments, might be adopted.

The horse equipment must be as light, and yet as serviceable, as possible; for a combination of these qualities the present kit of the regular cavalry seems best.

I would point out that although it has always been said that unless you firmly exclude any cavalry element from mounted infantry, they will gradually affect cavalry ways and equipments, and insensibly relapse into inferior cavalry, the Yeomanry must not be subjected to this rule. From the days of the Commonwealth the Yeoman has served as a horse soldier, he joins the service now-a-days to be a horse soldier, he is fond of his horse and fond of riding; if he had wanted to be a foot soldier he might have joined the Volunteers he will tell you, and if any attempt is made to convert the force into foot soldiers it will evaporate. No, the Yeomanry must still remain in the category of horse soldiers, and if the term Mounted Rifles is considered synonymous with Mounted Infantry, let them, as already suggested, have the good old name, Dragoons. Still, some change must be made, and if the Yeoman is dressed, trained, and equipped less like the regular cavalry, and more upon the lines so feebly sketched out in this paper, he will become as valuable a unit of our military forces as the most enthusiastic among us can desire.

It only remains to be considered how these changes may be effected. The slight alterations in drill, the establishment of sections, &c., might be introduced by a stroke of the pen. The rifles should be issued by Government. The Wallace equipment and Morris aiming tubes should also be issued by Government, but paid for, where possible, by regimental contingent funds; and to ensure their being kept in a condition of efficiency, Inspecting Officers should be directed to report upon them annually. Regiments should be ordered to supply themselves from local sources with linking straps if approved.

The only change really necessary in uniform would be in the head-dress, belts, and tunic of certain regiments. As a rule, regiments wear dark blue breeches and boots, and also white belts; but taking into consideration the necessary alterations, and cost of rifles, a uniform sum of 5*l.* a man would probably be required. Taking the force at a minimum of 10,000, this would amount to 50,000*l.*, which might be distributed over a period of five years by an annual addition to the Yeomanry estimates of 10,000*l.* Considering that for many years not a shilling has been added to the usual rate, and that the estimates for the Volunteers have year by year been increased by many thousands, the authorities ought not to grudge an expenditure which, though trifling in amount, would increase the value of the Yeomanry to a very considerable extent.

I trust I have shown that the Yeomanry may become an auxiliary force of very great value. It remains to be seen whether the authorities will make any attempt to produce this result; it will be urged, doubtless, that auxiliaries are never to be depended upon. I contend that the Yeomanry will form an exception to this rule, for even if acting against an enemy, they would never be subjected to the

heavy fire which auxiliary infantry, such as Militia or Volunteers, must be prepared to face, if they are to be relied on. I would add that, if ever this country were invaded, the weak establishment of our regular cavalry would render every man of the Yeomanry indispensable, even if the force were disarmed, for the performance of orderly and similar duties.

It would be a matter of regret should such a body of men be lost to the country, but if they are to be retained, the Government must at once show them some substantial encouragement. Depression in agriculture and trade has produced its natural effect in the ranks, and last year only some 9,000 men presented themselves for training. It is difficult to say in what form encouragement can be extended to Officers, for these are evil days for landlords, and in some districts a difficulty is felt in obtaining suitable men for the commissioned ranks. It was unreasonable to deprive the Yeomanry of their trumpeters, and to compel Officers to provide and to mount these most necessary men. It is equally unreasonable to expect Captains of troops to mount their permanent serjeants. Such expenses as these should be defrayed by Government, and where it can be shown that Commanding Officers are put to serious expense, in consequence of the insufficiency of the annual grant of 2*l.* per man, it should be increased to the original allowance of 3*l.* Commissions in the regular cavalry should be given, not as at present to Militia, but to Yeomanry subalterns.

The men of the force were formerly exempt from horse tax for one horse: strange to say, this exemption retained many men in the service who would otherwise have left it. In lieu of this, let Yeomen be exempt from serving upon juries. This would be a remarkably inexpensive method of attracting recruits, but would doubtless have a considerable effect in filling the ranks.

In considering the organization of such a body as the Yeomanry, it must first be determined whether it is to be regarded as an auxiliary force, a reserve, or as a force combining the nature of both. In the preceding remarks, I have treated the Yeomanry as a purely auxiliary body, being convinced that the existing constitution of the force debars it from being anything like a reserve to our regular army. The men come from a class that is never likely to furnish recruits, and the horses are their own property.

It is, however, indisputable that our regular cavalry are at present absolutely without reserves, and it is very desirable that the Yeomanry should, in some way or other, supply the deficiency. This, though, can never come to pass unless some radical changes are effected: such changes must cost money, and any proposition involving expenditure, even though aiming at the establishment of a cavalry reserve, will probably be dismissed without a thought.

In order to invest the Yeomanry with the nature of a reserve, a modification of the infantry dépôt system might be adopted. The regular regiments, without in any way altering their existing numbers or designations, should be localized in districts, a certain proportion of Yeomanry regiments being told off to each. The cavalry reserve men should

be attached to the Yeomanry regiment of their native district. They should be clothed and equipped by the regiment with the aid of a special grant or allowance; they should be called out annually at the permanent duty, and, if necessary, for a certain period previous to the training, when they should be under the command of the Adjutant. As the Yeomanry are now subject to military law whenever under arms, there would be no difficulty in dealing with the men of the Reserve; but any special provisions for their discipline could easily be made.

A limited number of men should be allowed to join the Yeomanry without horses, but they should for a certain period be liable to be called upon to serve in the regular cavalry. In order that this should not be distasteful to the class ordinarily serving in the Yeomanry, no men should be attested unless bearing exceptionally good characters.

These men should be mounted by requisition. A certain number of horses should be selected annually and registered, their owners guaranteeing, for a certain consideration, to produce them for duty whenever required; these horses should be annually inspected and reported upon by the Inspecting Officer at permanent duty.

To induce farmers to fall in with this idea of requisitions, some *quid pro quo* must be offered by the Government. To make any suggestion on the subject seems a waste of words, but I should like to see a well-bred entire horse, with plenty of bone and substance, kept at each of the miniature dépôts I am about to describe; these horses should be occasionally transferred to different counties, and should serve gratis a certain number of mares likely to breed cavalry horses. The owners of these mares would of course own the produce, but would be liable to have one or two colts registered as described already, or even purchased at a reasonable price by Government. This would be a very different thing to the risk and expense of keeping a number of mares, and would entail no additional staff. It would, to some extent, mitigate the serious falling off in the quantity and quality of horses at present in the country, which is beginning to constitute an obstacle to the maintenance of the Yeomanry, and the effects of which must ere long be felt by our regular cavalry.

Small barracks, containing Adjutant's quarters, stabling for about twenty horses, a riding-school, quarters for thirty or forty men, orderly-room, &c., should be built at the headquarters of Yeomanry regiments. The staff should consist of the Adjutant, relieved when necessary by a qualified Yeomanry Officer, and assisted by a regimental serjeant-major and assistant riding-master, as well as recruit regular or Yeomanry Officers. At these barracks all recruits and remounts for the regular regiment of the district should be trained, the Yeomanry and Reserve horses coming up for training as required, remounts being purchased as far as possible in the district, and by the dépôt staff, the Yeomanry veterinary surgeons being employed when necessary.

The advantages of such a system would be an immense saving of time to the staff of regular regiments in training recruit men and horses; a great saving of expense when the preliminary cost of

barracks, &c., was absorbed; an extension of the territorial system to the cavalry, without all the drawbacks and heartburnings which that system has evoked in the infantry; the organization of a regimental reserve, and the formation of a bond of union between the regular and auxiliary cavalry which would prove an advantage to both.

The consideration, however, of such changes as the above would entail, should not interfere with the suggestions which have been made as to the Yeomanry proper; if converted from merely an auxiliary force into an auxiliary and reserve, it must not be forgotten that their qualities and energies will be wasted unless they are trained and equipped as Dragoons or Mounted Rifles. Such drill will not make the Reserve men who may be distributed amongst them one whit the less fit to take their places in their old regiments; it will rather sharpen their wits, and help to counteract the evils of a relapse into civilian existence.

The CHAIRMAN: I am sorry to see so small an audience to listen to such a very interesting lecture. I hope that, though the number here is but few, there are some Officers present who will enter into the discussion which should always follow the lectures in this Institution, and will give us the advantage of their views on the subject.

Colonel MUSSENDEN, Inspecting Officer for Auxiliary Cavalry, Aldershot. I am sure we all endorse what the Chairman has said as to the very great interest of the paper which Major Edwards has read to us. I may say from my knowledge of Major Edwards that he is one of the most zealous Yeomen that we possess in the force, and he has also, not only in the North of England but in my district, had very great experience, from personal observation, of the merits of the Yeomanry, and is therefore very well qualified to give us this lecture. There has been a good deal in the paper that he has read to us in which I entirely agree, though some points which he has raised may be open to discussion. He has very properly told us that cavalry duties are to be divided into two parts: the actual attack, and the detached duties of cavalry. Now, as regards the actual attack, he tells us that Yeomanry are unfit for such duties, that they are unfit to take part in the shock of cavalry. I must say that I think he is rather hard upon his branch of the Service in saying this. I have been told that when the Yeomanry have been called out in aid of the civil power, along with the regular cavalry, on many occasions the mob seemed to care little for the regular cavalry, but they bolted as soon as the Yeomanry were let loose: the reason being that there was very great difficulty in stopping the Yeomanry when they were once set in motion. They rode over everything, and were really most effective. I do not know how far that would hold water in the case of European warfare, but from what I know of the Yeomanry I think that they can make a very effective attack in line. I quite agree that more attention should be paid to detached duties, outpost duties, reconnoitring, scouting, and so on, and I think the Yeomanry are admirably adapted for these particular duties. They are an intelligent race of men, they ride well, and know the country. The main question, however, comes to this: is the Yeomanry of the future to be composed of auxiliary cavalry, or is it to be composed of mounted infantry? I think there is no medium between cavalry and mounted infantry. If you give the Yeomanry the long rifle you ought also to give them the Elcho bayonet, or some weapon with which they can fight their enemy on foot when their ammunition is exhausted. If you give them the long rifle, it is essential that the sword should be removed altogether, and that the Yeoman should no longer depend upon his sword. Being armed with the long rifle and the Elcho bayonet, he would still be available for many of the detached duties of cavalry, scouting and so on; but no body of mounted infantry should ever be detached without having a strong cavalry support at hand. No doubt the mounted infantry in Egypt did admirable service, but they

were not opposed by very formidable cavalry. Had they been, I do not think they could have gone quite as far ahead, and have left their horses as they did. I consider the rôle of the mounted infantry is rapid transport from place to place, sizing and holding positions, bridges, defiles, &c., but on all occasions trusting solely to the rifle and the bayonet. As at present constituted the Yeomanry has attained a certain degree of efficiency as auxiliary cavalry, and it must be remembered that the 14,000 Yeomanry that we have at present represent the whole of the volunteer cavalry for a force of volunteer infantry amounting to some 200,000 men; and surely this is not too large a proportion of cavalry. The Yeomen proper—the farmers of England—are good horsemen from their childhood, able not only to ride across country but to train their own young horses in a very short time. If it were not for that, they would be able to do very little in the few days' training allowed them in the year. I think it would astonish many cavalry Officers to know what a very large proportion of three-year-olds are brought out for training—horses that really have not been backed half-a-dozen times before they are put into the ranks; but the men are able, from their good horsemanship, very speedily to get these animals into shape. I would not believe that such was the case until I had looked at some of the horses' mouths, and found that many of the horses were three-year-olds, while some were only rising three. I am afraid the shooting of the Yeomanry is not good—my experience being that good shots are the exception, not the rule. Much attention is now being paid to the subject, and I hope the shooting may improve, but at present I am afraid it cannot even be called indifferent,—the shooting of the Yeomanry, I should say, is bad. Some regiments pay more attention to it than others, and shoot fairly well; but the shooting of the Yeomanry, generally, is, no doubt, its weak point. I consider, for that reason if for no other, that the Yeoman proper is better adapted to fight on horseback than he is on foot. Of course Yeomen who are not tenant farmers, and who live in the neighbourhood of large towns, have advantages with regard to shooting which may render them as good shots as the volunteers; but those men have not the cavalry qualities of the Yeomen proper—I mean the agricultural portion of the force. One troop of the Middlesex Yeomanry is about to be armed with the long rifle and the mounted infantry equipment, as an experiment. We shall all watch this experiment with great interest, and if it succeeds I have no doubt that other Yeomanry corps will ask for a portion, at least, for their regiments to be armed with the long rifle. I have already had one or two applications for long rifles from regiments in my district; but I have told them it would be better to wait to see the result of the experiment in the Middlesex Yeomanry. Now about the Cavalry Reserve. I regret that there should be any need to enter into the question of how the Cavalry Reserve and the auxiliary cavalry might be brought together for mutual benefit. The cavalry service is now limited to seven years, and at about the age of twenty-five a soldier is relegated to civil life—entirely very much to the loss of his regiment; and what is the gain as regards the formation of an effective Cavalry Reserve? Have we any reserve cavalry horses, or how can we form a reserve of cavalry horses? Cavalrymen, as a rule, are not enlisted, as are the Yeomanry, from the riding class, and when they go back to civil life most of them are entirely separated from horses and from stable duties. In two or three years they become as helpless as a recruit, with the addition of the stiffness which so surely follows advancing years; and it is much more difficult to make an efficient cavalry soldier of the reserve man who has been two or three years away from his regiment than it would be to make an effective cavalry soldier of (say) a London sharp boy that you pick up at the age of eighteen. It is very different to the case of the Infantry Reserve man, who goes away from his regiment, but does not of course lose the power of walking about and marching when he goes into civil life; he comes back, soon picks up his drill, and becomes the backbone of his regiment. I cannot say how it would work in the Cavalry, but supposing we were to try to amalgamate the Cavalry Reserve and the Yeomanry, I am afraid there would be a great many difficulties in the way. In the first place, I can only see one way of doing it, and that is by providing horses from the nearest cavalry regiment for the use of the reserve men. Now, if Yeomanry were scattered all over the country with the Cavalry pretty equally, something of that sort might be done; but take the Southern District, for instance: that district contains three Yeomanry

regiments, but it has not a single Cavalry regiment quartered in the command. The Western District is still worse, for there are eight Yeomanry regiments, and not even a cavalry barrack in the command. It would be very difficult, I think, to provide horses for the reserve men in those two districts. It could only be done by sending them from Aldershot, and, probably, Commanding Officers would very strongly object to lending their horses to unknown riders. But even the reserve men themselves would be very unevenly distributed. In some counties the reserve men might be counted on the fingers of both hands, but the Cavalry Reserve in London alone would amount to some couple of hundred men, more or less, and increasing every year. If those men were called up for a week's training with the Middlesex Yeomanry, it would become a question how they were to be mounted. I should doubt very much if the Commanding Officers of the Household Cavalry would not very strongly protest against sending a couple of hundred of their black horses to mount the reserve men; and even supposing you could get the horses for them, I am very much afraid the two classes would not amalgamate very well during the training. In the first place, the reserve men are not as well off as the Yeomanry, and especially as the Middlesex Yeomanry, and if they were called out, billets would have to be drawn for them, and, in whatever town they were called out, the fact of drawing billets would make the Yeomanry very unpopular. I do not think publicans like putting up soldiers on the march, even for a single night: in the North of England they very strongly object to it; but they would certainly not like to have to put the reserve men up for a whole week. Many Yeomanry Officers have told me that the ordinary expense that a Yeoman is put to for his training amounts to as much as 5*l.*, in addition to the 7*s.* a-day which he gets as his pay. I have no doubt whatever that a very great hole is made in a 5*l.* note by the week's training. The lecturer made several suggestions. One was about dismounted service—the advisability of dismounting a larger number of men. I think we may fairly divide the dismounted service into two heads: temporary duty—when you would merely dismount one-half of the men, as laid down in the Cavalry Regulations; and the more permanent dismounted duty, when you would dismount your whole troop or squadron, and link the horses in the ordinary way. I am afraid the system of linking the horses by the mouth would not be found to answer; the horse's mouth is very sensitive, and I would prefer Major Bower's plan of fastening the thong to the collar-ring. As regards working in single rank, I think there is no objection at all to regiments working in that way,—in fact, all the weak regiments do work in single rank. I am glad to say we have got some strong regiments still left in the Yeomanry, and I think, if they worked in single rank, one man's voice would hardly be of sufficient power to reach the whole of the squadron. As a matter of fact, a great many regiments do work very well in single rank. As regards uniformity of equipment, I should rather deprecate any general alteration of the uniform, and for this reason, that any change of uniform would fall not upon the public but upon the funds of the regiment, and some of the regiments are not so flourishing in their funds that they could afford a new equipment. If we were forming a new regiment I should strongly advise some sort of uniform like that now worn by the East Kent Yeomanry (Mounted Rifles), which is a most workmanlike and soldierlike dress. It is very much like the uniform of the 60th Rifles, or what used to be called the 60th Rifles. I am afraid I have trespassed too much upon your time. I will only say, in conclusion, that I am a great believer in the Yeomanry; I think they have gallantly struggled to keep their heads above water during four or five years of very great agricultural depression, and if anything could be done to encourage them, or to make the public believe that the Yeomanry of England is a valuable addition to Her Majesty's Forces, it would afford me, personally, the very greatest satisfaction.

Major AGLAND, M.P.: I perhaps ought to apologize for addressing this meeting, seeing, as I do, before me so many men of much more knowledge and experience than myself. But on this particular subject I hope I may claim, as both a Volunteer and Yeoman, to have had some slight experience in a purely amateur way. I have been in a Yeomanry regiment for fifteen years, and before joining the regiment I had command of a Mounted Rifle Volunteer corps, raised by my father, of which I retained the command for fifteen years, holding the double command under a special

provision—which I daresay the Inspector is aware of—that used to be in the Regulations for the purpose. That Volunteer Rifle Corps was equipped almost precisely in the manner in which Major Edwards proposed that the Yeomanry should be equipped for the future. We carried long rifles, for ten years, in Namaqua buckets. The men used to go over fences at a smart pace; they came up to Wimbledon, and were never lower than third in the competition for the Loyd-Lindsay prize for four or five years. They were second two or three times, and third once or twice; being, several of them, very good shots indeed. The principle of their training was different from that of the Yeomanry. The Yeomanry go out for eight days' permanent duty. The Mounted Rifle Volunteer Corps of Devonshire, of which there were five at one time, used to go out about a dozen or fifteen times a year, for two or three hours' drill in the afternoon. It was perfectly easy for them to ride away after their dinners, and get home again to their teas without any one missing them. And we were able in that way to keep together thirty or forty men as a Volunteer Corps. When the Yeomen who had learned their drill in the Yeomanry got too old, or were married, or perhaps lost their father or brother,—whoever was helping them on the farm during the time that they were out for their eight days' duty,—when they lost that helper they used to leave the troops, and come into the Mounted Volunteer Corps, because, although they could not afford to be away from their farms for eight days at a time, they could easily ride away from their farms for two or three hours in the afternoon, and get their two or three hours' drill, a dozen or twenty times a year. Colonel Oakes inspected us on many occasions, and if he were living now, I think he would willingly testify that that corps was just as smart as any Yeomanry troop that he would wish to see; in fact, he said so over and over again. I believe he used to say the same of Colonel Bower's corps which was enrolled a week before the corps I had the honour to command, and was disbanded about six weeks before mine, so that I believe the one I had was the last Volunteer Corps in England of that description. I have said this in order to show that it will not be the first experiment in carrying long rifles that is about to be made by the Middlesex troop of Yeomanry. We carried them successfully for ten or fifteen years, and found it perfectly easy to cross country with them, or to do anything else. There is this advantage about the Namaqua bucket—that a man may gallop up, and during the last 3 or 4 yards of his gallop he undoes the loop, and as he dismounts he pulls the rifle over the near side with him without the slightest difficulty—even more easily than with the ordinary cavalry bucket.

COLONEL MUSSENDEN: Had you the sword?

MAJOR ACLAND: We used to carry swords; we had the bayonet at first. The sword in one of the Volunteer Corps was carried with a flat hook, which was hooked on to the belt. Below the hook, as part of the same piece of iron, there was a ring, and when the thing was unhooked, as it could be by a single motion, it enabled the sword to be hung on to the front of the saddle, and there it was perfectly safe, and the man could run about free without his sword. That was the great difficulty we had to solve—how to get the sword attached to the saddle. That was tried for a certain time, but we did not carry it very much into effect. As a rule we kept the swords on the men, because we found it, on the whole, easier to adapt the drill which Colonel Bower's volunteer rifle drill embodied, of extending to considerable distances in sections of four and dismounting half of each section, never taking them more than 10 or 15 yards from their horses, and closing again mounted. It was more easy in that way to cover a large extent of country. You could cover two or three sides of a field, or get through a wood, more quickly in twos or fours than in larger bodies of men. But we also used to have a drill very much analogous to the present double rank cavalry drill—but which we always practised in single rank only. We found it perfectly easy to work two or three corps together. The Inspector made one or two remarks which I hardly like to criticize, but at the same time, as I have an opinion upon them, derived from fifteen years' experience in the two particular branches, I venture to suggest one or two points in which we do not agree. I cannot sanction the statement that the Yeomanry men, in the regiments that I know, spend anything like 5*l*. when they come up for their eight days' training. I do not think that they do in most regiments, although I know some are much more expensive than others. It depends to a large extent on the habits of the men.

Colonel MUSSENDEEN : I only judge by what I have been told.

Major ACLAND : If I could not tell my friends among the farmers that their sons would not have to spend any more than a pound or so beyond their pay, I am afraid very often I should not get them; and as I do get them, and, what is more, keep them, I gather from that that they do not cost their fathers more than a couple of pounds at the outside. The exemption from the horse-tax, which used to save a man only 10s., was, I always found, quite enough to get a farmer to send his son into the Yeomanry. There is one other point about the sword. I quite agree in the difficulty of teaching Yeomen to use their swords; I believe it would be almost impossible to teach Yeomen to use their swords efficiently; but at the same time, if we are to have any large section of the body dismounted, and if they are to have a support, would the support be of any use without swords?

Colonel MUSSENDEEN : No; I said a cavalry support.

Major ACLAND : A cavalry support would have to be a regular cavalry support, or it would entail teaching the auxiliary men the use of the sword: that is all that I mean. Some part of the regiment would require to have swords. With regard to the outpost duty, I have found it of the greatest possible interest to the men; and our constant practice has been to get squadrons together, even sometimes for a couple of days' drill, at 20 miles' distance, and to get them to reconnoitre against one another; and I think, on one or two occasions, those who were first discovered had to pay for the luncheon of the other men: at any rate, it made them exceedingly keen in their work. I want to make two practical suggestions, because I hope that Major Edwards will take care that this most valuable paper of his comes before the authorities. One is this: one of our great difficulties is to get the men who have been in the regiment for four or five years to come up to the extra drills. They are men of business, and the Yeoman gets no pay whatever for his extra drills. He gets his 7s. a day for the eight days' permanent duty, and he is expected to come to a certain number of drills besides. The Government seem to have forgotten that the Volunteers come for their drills almost as an amusement, and at no expense to themselves, beyond shoe-leather; but the Yeoman cannot come up to mounted drill without taking both himself and his horse away from his business. The horse is worth at least 7s. a day to him on his farm, besides the superintendence that almost all men who compose Yeomanry regiments have to give to the practical work of their farms. They have to ride away 10 or 15 miles, and to give the whole day to their drill. Practically they are put to an expense which, at the minimum, is 7s. a man. Now I should be glad if we could persuade the Government that it would be a great inducement, and worth doing if they wish the Yeomanry to be of any service, if they would give us, instead of eight days' pay for permanent duty, of which in several regiments one day is taken up in marching in, and another in marching out,—if they would give us half-a-day's pay for each of those days, and give the whole day's pay thus saved to the extra drills, *i.e.*, give 2s. 6d. for each extra drill; for you require three extra drills from every Yeoman. But of course I should very much prefer if you would give us an *extra* day's pay in that way.

Colonel MUSSENDEEN : Ten days' pay?

Major ACLAND : I do not think it would quite answer to give ten days' pay—for this reason: there are very few men who can afford to be away from their business for ten days; eight days is the outside, and many of them want a day's leave out of that; but there is this that can be done—and I think it has been done in one regiment—that when a man has been in the regiment for three years, and has been passed by the Adjutant as an efficient man, he should be allowed not to come into quarters until the third or fourth day of permanent duty. Because the result of the present system is, that you have on the first day of permanent duty, say twenty per cent. of your troop's recruits; whereas, if you had the recruits out by themselves for two or three days, you could teach them all the elements of squadron drill—to move about, increase and diminish front, and to know what wheeling is, and riding, and so forth. And then by the time the old soldiers were coming into quarters you would be able to get the regiment together in an hour instead of taking a couple of days about it, as at present.

Colonel MUSSENDEEN : Then they would have only four days' pay.

Major ACLAND : I should like them to have the other day's pay for extra drills,

because they are most valuable at separate troop drills, in helping the young soldiers to get into their places. There is another suggestion which Major Edwards has made in his paper. I do not know whether he ever heard Colonel Oakes speak about it, but I remember Colonel Oakes saying to me, many times, that if ever I had the honour of getting into Parliament, he hoped I would keep it continually before the authorities. The suggestion that I refer to is in the last paragraph but two or three. I may say, I have made the suggestion to Lord Hartington, and he listened with considerable interest, and begged that I would remind him of it when the proper time came; so that the additional authority given to it by Major Edwards's spontaneous suggestion will, I hope, not be lost—that is, as to the establishment of breeding *depôts* all over the country. There is only one other thing I wish to mention, and that is to express my sense of the great importance that I think all Yeomanry Officers, who have experience, attach to the instruction at Aldershot. Nothing has been more valuable to the Yeomanry service than the establishment of that Aldershot school. I do trust that the authorities will maintain strictly the obligation of all Officers to go through that school, if it is only for a fortnight or three weeks. The elementary and skilled instruction given there gives the Officers confidence in themselves, which afterwards gives their men confidence in them; and if the authorities would carefully peruse the suggestions of Major Edwards, and would take the Yeomanry in hand, and make them feel that they want them to be of some use, I am quite certain that they would answer to the call.

Lieutenant-General Sir EDWARD HAMLEY, K.C.B.: Before having the slightest idea as to what course the lecturer would take, I devoted a short time to-day to the consideration of this subject, and—I say it with all diffidence and modesty, because I am not a cavalry Officer—the line of argument that he has followed has, to my great gratification, been such as had suggested itself to myself. We have in the Yeomanry a large body of men who, with intelligence, spirit, and zeal, are only asking how these qualities can best be turned to the service of the country. Major Edwards has told us that, I think, in the most effectual way. I do not propose to enter into the details which he has so copiously given us, and which have been so completely discussed by other Officers; I will only say that I quite concur with Colonel Mussenden in thinking that there is no medium between cavalry and mounted infantry, and that any attempt to produce a force between the two would only be to muddle and spoil both. On the other hand, I quite concur with Major Edwards in thinking that the best use you can possibly make with the Yeomanry is probably to form them into mounted infantry. I will not go any further into details, but only express my general concurrence in Major Edwards's views. I think it is very fortunate that the idea that he has given us should have come from within the force rather than without. I think it is a matter of great promise for the Yeomanry that an Officer who has evidently given so much attention to the subject as Major Edwards, and with such excellent results, and who is capable of expressing his ideas in so clear a manner, should give us the benefit of his views. It is a step in the right direction, for in case of invasion a large force of Yeomanry would be at the disposal of the Government, and it is most important to consider how it could be turned to the best account.

Major HELYAR, 3rd Hussars, Adjutant West Somersetshire Yeomanry: I wish to say a word with regard to the shooting of the Yeomanry. At present we have thirty rounds given us per man, and I think that if the authorities would only increase that to forty or fifty it would be a very great advantage. In my own regiment last year we bought 10,000 rounds more than the amount actually supplied by the authorities, and this year we have already bought in 5,000 rounds. I think an increased allowance of ammunition would assist in making the men better shots. I would also suggest that Yeomanry non-commissioned officers should be permitted to go to the school at Aldershot; if this encouragement were given them, and if they went under some system whereby they had a certain amount of the expenses paid them while they were there, you would find a great many of them would go. I should like also to see the permanent staff go to Aldershot, or to some other cavalry centre, either every year or every two years: for then I am sure the Adjutant would have a much easier task in

keeping them up to their work and preventing them getting into slovenly habits. I go further than Major Acland, and say not only would I pay them two shillings and sixpence for each troop drill, but I would ask the Government to give each man who turned up at troop drill his day's pay just the same as if he were on permanent duty. I should also like to see the permanent drill lengthened by two or three days if we could have it. I do not think the suggestion with regard to the men being let off the first two or three days would work very well. I should also like to see the Yeomanry supplied with equitation articles, such as single-sticks, masks, and tent-pegging spears, so as to help them becoming good horsemen and cavalymen. I should also like to see troops of Yeomanry regiments encouraged to go to the drills at Aldershot; I am sure we could get up a certain number of men from every regiment if we only had a certain amount of assistance given us. With regard to what has been said as to the Yeomanry not learning sword exercise, I think if Officers could go to North Somerset they would see a regiment that will go through its sword exercise almost as well as any cavalry regiment they have ever seen.

Captain BICKERSTETH, Middlesex Yeomanry: I wish to say a few words on one or two points. I thoroughly agree with a great deal of what has been said about the importance of teaching the Yeomanry shooting, but I am rather afraid of the term "Mounted Infantry." I much prefer the word "Dragoons." From the little experience I have had in connection with a regiment in the midland counties for some years, I am quite sure the Yeomanry so thoroughly look upon themselves as cavalry that I doubt whether you would find the same class join the ranks if they thought they were joining as mounted infantry; they are a class particularly open to the influence of sentiment: even the removal of the exemption from the horse-tax had a very great and damaging effect upon our recruiting, and I think any proposal which made people believe that the Yeomanry were going to be turned into mounted infantry might be equally injurious. Out of a nominal force of 14,000 Yeomen it appears that last year there were only 9,000 actually out for training. It has been exceedingly difficult for the last few years to keep troops up to their proper strength, and we should be very careful how we introduce any change which would frighten our troopers, or make them think that they are not going to be regarded as cavalry. There is another point which struck me as I listened to Major Edwards's interesting lecture. The mounted infantry in Egypt were picked shots, and perhaps it would not be possible in a regiment of Yeomanry to get the figure of merit anything like as high as it ought to be if they are to be relied upon as mounted infantry. The idea of having a troop formed of the best marksmen or the best shots of each regiment as mounted infantry, or having a certain number of men in each troop told off as marksmen and equipped with the long rifle and Namaqua bucket, might, I think, be worthy of consideration; but if you were to turn whole regiments of Yeomanry into mounted infantry, and to rest in the belief that the country was well provided with that branch of the Service, I think that you might find in time of need that you were leaning on a broken reed. With reference to a longer period of training I used to find that the men in my troop came from very long distances; they were nearly all farmers, and they would not in the least have objected to a longer training, say for even fifteen days, if they could be sure of getting two days' leave in the course of the training. What they felt was that when they were more than a whole week away from their farms they could not know how things were going on. During the eight days the men were continually coming to ask for leave for one day to go back and see how their farms were faring: but if they could pay two unexpected visits to their homes during the training, they would not mind being out for a fortnight. Again, I was frequently told that if the Government would give them some little encouragement it would be a great inducement for men to join. They often mentioned exemptions from service on juries as a privilege which they said would almost be the same thing as the exemption from the horse-tax. It is not so much the actual value of an exemption, because to a great many of the Yeomanry the pay is really a small matter, but they like being recognized by the Government. As I have already said, Yeomanry are a sentimental class, and if we could get some little privilege of this sort, I think the Government would find it quite worth their while to grant it. There is one other point with regard to the Yeomanry upon which I feel strongly, and it is a matter that I think the Officers of Yeomanry regi-

ments have very much in their own hands. Constantly, when trying to get recruits, it has been thrown in my teeth—"Yes, but it is such an enormous expense." It is not only so in the regiments in the South of England, but in my former regiment I know that the Yeomen were put to very great expense beyond their pay, much more than 1*l.* or 2*l.*—I should say nearer 5*l.* for the week. Men do not like to join a regiment unless they can live as their comrades live, and I think the majority of Yeomen would be glad if, without loss of credit amongst their comrades, they could live more cheaply during the training.

Colonel MARSLAND, late 5th Dragoon Guards: It has afforded me great pleasure to hear this admirable lecture. I have always taken very great interest in the Yeomanry, and have thought that, if they were only properly instructed and looked after, they would be one of the most useful forces in England. Major Edwards says: "Every regiment may be depended upon to furnish guides for any part of its district." I am very glad to hear it, as I have always thought that was one of the chief uses that the Yeomanry might be put to,—that if a force were marching through England, the General would call upon the Yeomanry Officers to supply guides for the different districts. Major Edwards also said that every man could write and read, a matter of no small importance for reconnoitring—"a fair proportion can read and understand a map." I quite agree that the non-commissioned officers should be instructed how to reconnoitre: they should attend the classes, and in addition to that, after they have been instructed, they should collect their men together during the winter months and explain about the reconnoitring—not only how to reconnoitre but how to report. A great number of men are very fond of saying, "We have seen the enemy," but they cannot enter into details, and so the information they bring back is simply useless. A great number of them will ride several miles without being able to tell the General that they have crossed a bridge, or that there was a river, or that the country was enclosed. I think men, during the winter months, should be instructed in this important duty. With regard to carrying the rifle, I think myself every dragoon should be armed with a rifle with a sling attached to it. The rifle and sling should be carried on all ordinary occasions in a bucket as at present, and previous to the Dragoons coming into action the word of command should be "Sling arms! draw swords!" If a man's horse is shot, the carbine or rifle and any ammunition is not then separated. With regard to Major Edwards's plan for the linking of horses for dismounted service, I think too much importance cannot be attached to dismounted service with cavalry, and as to the fastening not being strong enough, we all know from experience that cavalry horses, after a few days' service, require very little to hold them. I think it is a most admirable suggestion, and should like to see it carried out.

Sir THOMAS ACLAND, Bart., M.P.: May I be allowed to say one word only on a main point of principle? I have listened with the greatest interest to this debate, and feel very proud to see my friend Major Edwards placed in so honourable a position as that of having given a lecture to-day, and having received so many compliments from military men for the quality of that lecture. But I confess I feel a little discouraged by what I have heard. We are told plainly, by high military authorities, that you must either have cavalry or mounted infantry. I have heard a little of what happened in Egypt from one of the noble soldiers who commanded there, and I am afraid that is true. Well now, if that is true, much as we admire the ability and skill and tact of the Major's lecture, what can we do in the direction he points out? He is asking the country to convert the Yeomanry into a Mounted Rifle force. He is told on high authority that it must either be infantry, or it must remain as cavalry. Now the principle which seems to me to stand in the way (and I venture to lay it before you as military men, who understand these things far better than we civilians can) is that these old-established auxiliary forces (the Mounted Rifle Volunteers were an exception under special influences) will not bear to be put upon any special ground, and they will only endeavour to follow and imitate the army. If you have in the regular army a body of mounted riflemen, not merely in name but in fact, either dragoons or carbineers, no doubt you can get the Yeomanry to follow them: you can tell the Yeomanry, "There is your pivot, you must form upon those men;" but I do not think you will get the present Yeomanry Cavalry regiments to consent to be

converted into anything which is not in the army. I was recently talking to a very experienced old civilian country gentleman, a Colonel of Volunteers and field Officer of Yeomanry, and he said, "There is another fact involved in this question, that if you do not follow the lines of the cavalry, all your drill instructors and your sergeants will be up against you directly; they will try to follow the routine they have been used to, and it is extremely difficult to get them out of it." That is the main principle which I venture to submit to this meeting. I feel very grateful to you for having taken up our subject. I do hope some day military men will be able to induce the War Office to give us something like a training school for educating drill instructors, and teaching them how to teach.

The CHAIRMAN: You must work that in the House of Commons.

Sir THOMAS ACLAND: I have worked it there; but I am getting too old now. As you are so kind, I will say one word more about Mounted Rifle Volunteers. You have heard the experience of a younger member of my family. For fifteen years we kept our Mounted Rifle Corps; we had five or six of these corps in Devonshire, and kept them together in spite of discouragement from headquarters. I am bound to say General McMurdo took great interest in them, but he made us carry swords. These men found their own clothes and saddlery; the whole thing was worked most economically, even to the extent of our little arrangements for feeding when we went out. The Government, however, would not give us more than the exact sum given for ordinary infantry volunteers, and this is what broke us down at last. We could have managed to pay our way no doubt: it was not the money that stopped us; but there was so much discouragement implied in the refusal to recognize the expenses of mounted men and horses. At last, Colonel Oakes, who devoted himself to the improvement of the Yeomanry, said, "I cannot come down here to be bothered to inspect twenty or thirty men."¹ In short, the whole thing was snuffed out from headquarters. We showed, however, for fifteen years that it was possible to get a number of farmers together, dressed in plain grey jackets, corduroys, and boots, who could ride and shoot well. That could be done yet, with proper encouragement; but I do not think you will get the Yeomanry to consent to being turned into mounted infantry.

Captain PHILIPPS, Pembroke Yeomanry: I belong to a regiment in South Wales where our men are widely separated, and I think, inasmuch as troop drills seem to be considered a very essential and important part of our duty, every encouragement should be given to enable us to carry them out efficiently. We had a meeting of Officers the other day, and considered the matter very carefully and anxiously, and the only practical plan we could suggest was (if possible) to get our men together for two days running; but in order to do that we should have to stop at the rendezvous for the night, and it seems to me that if the Government would allow some 3s. or 4s. a man for the drill it would be a great assistance when urging attendance. The men do not care so much for the actual money they receive as for not being put to expense; and I always find a Yeoman does not object to giving his time, but does not see why he should pay for his horse as well. As to the shooting, we have tried our best to improve it by giving prizes. We find this has made it very popular, and the men are very happy and willing (when they can get even a sweepstake prize amongst themselves) to spend two or three days from morning to evening at shooting practice. I think if the Government were not stingy in these little matters, such as giving us one day's pay for our troop drills and as much ammunition as we can properly use, it would be a very great help in keeping our force together. Above all what we want is some recognition. It has been a very great blow to us to have the horse duty done away with. There was a sort of "swagger" in a man's feeling that he was in a better position than his neighbour, and I really

¹ I think it was a fatal mistake when the Mounted Rifles were detached from the administrative battalions of Rifle Volunteers. As long as I commanded Rifle Volunteers, whether as a Brigadier or regimental Colonel, the companies of Mounted Rifles attached were of the greatest value on all occasions of assembly, both as to transport and in combining and communicating with different bodies. As soon as they were placed under cavalry inspectors, I felt that their doom was sealed.—T. D. A.

think if some such recognition in some other form could be given it would tend very much to increase the popularity of the force. For instance, if every man who was efficient were allowed to keep a pair-wheeled trap free of duty it would be asking the Government for very little more than the horse duty; *but* it would be giving the men a very great "swagger" over their friends and neighbours. I think if a man could drive about in a pair-wheeled trap, and say, "I pay no duty for this," a great many would join the corps. I have studied the Yeomanry considerably, and the few remarks I have made have been based upon the result of that study.

Lieutenant-Colonel HARFIELD, Middlesex Yeomanry: I wish to make one remark with regard to the course I have adopted, namely, that of having applied to the War Office for permission to arm a portion of my regiment with the long rifle. It seemed to me that there was no more practical difficulty in carrying the long rifle when mounted than the carbine, and on *that* ground I made my application—not for the purpose of converting the regiment into "mounted infantry" (which I think is a term which, at present at any rate, would be very unpopular amongst Yeomen), but rather to increase the efficiency of our "dismounted service." Whether the change will be popular in the regiments or not will be seen after our next training; but at present it is only an experiment. I think also it would be unpopular amongst the men if the sword was given up for the bayonet; but on this point I shall be glad to know what Major Edwards proposes. For my own part I am inclined to think that for the Yeomanry, when at close quarters, the revolver is the best weapon.

The CHAIRMAN: I have had rather a shock to-day. I have heard something about sword exercise in the Yeomanry, who have yearly three or four days' troop training, and eight days' permanent duty. Is it a positive fact that you go through that antiquated farce at your inspections?

Lieutenant-Colonel HARFIELD: I am afraid we do.

The CHAIRMAN: I served for twelve years in connection with the Prussian army, and saw it through two campaigns, and I think I saw every cavalry regiment in the service inspected more or less, but I never saw any sword exercise performed. I was surprised to hear that such a thing existed. I have not seen much of our cavalry since I came home, and therefore I may be supposed to be in ignorance of that fact. I shall not make any remarks upon the lecture, because I think our time has been stretched to the utmost period for which a small audience could be expected to remain. I will only, therefore, express my personal opinion that it is one of the best lectures that we have heard in this theatre. It has been admirably put together, and, whether we agree with all Major Edwards's proposals or not, it has embodied a very large amount of excellent suggestion. As I do not intend to say more myself, I am going to put myself into the place of a better man. I had a letter, half-an-hour before I came down here, from an old and esteemed friend—Colonel Bower¹—the mention of whose name is quite enough to justify me in reading his letter to the meeting. He says,—

"Dear Sir Beauchamp,—I have this morning received a copy of the lecture on Yeomanry, which Major Edwards is to give to-morrow. I have read the paper with great interest, and much regret that I shall not be able to attend as a listener, and perhaps have been permitted to offer the lecturer my congratulations on the clear and practical views he holds on a subject which you and I know have long been regarded as of very great importance. I see that Major Edwards and I quite agree as to the necessity of Mounted Riflemen being a cavalry and not an infantry force; and I do most cordially hope that he may succeed in his endeavour to convert the Yeomanry from imitation troopers into useful dragoons, or whatever it may please the powers to call them. The lecturer's remarks on tactics, equipments, drill, &c., are so completely in accordance with the system which was introduced by me three and twenty years ago, as to re-kindle my hopes of yet seeing the desired conversion of the Yeomanry become a reality. I do not agree with Major Edwards's proposal to attach the sword to the saddle. I can quite imagine the inconvenience of a sword dangling between a man's legs in running, with a bunch of slings in

¹ 1st Hants Mounted Rifle Volunteers.

one hand and a rifle in the other, to say nothing of the *sabretâche* tripping up the runner; but all these troubles are easily avoided by carrying the sword in a frog, as we used to do in my late corps. With that equipment my men could skirmish on foot without being in the least impeded by their side-arm. The plan of attaching the sword to the saddle has drawbacks. Troops such as my late corps, and what the Yeomanry may yet, I hope, some day become, should have no fixed tackle about them such as may catch in branches in brushing through woods, or jumping fences. A sword fixed is liable to this drawback, and the plan of slinging the sword to *dees* in the saddle behind, if too low, comes in contact with the horse's hind legs in fast movement; and in jumping, unless the rider sticks very close, the hilt is apt to bound up and get under his fork, thereby incurring very great risk of personal damage. I see Major Edwards advocates repeating rifles and revolvers. My views on that subject are, and always have been, that one firelock is as much as any man ought to have, and that it ought for obvious reasons to be of the same sort, and carry the same ammunition, as that of the line. I must apologize to you for obtruding my views on you; but I am not able to attend the lecture, and consequently am precluded from taking any part in acknowledging the good work Major Edwards is engaged in, and therefore, through you, I take the liberty of tendering my best wishes for the success of the cause.—Believe me, yours very sincerely, J. BOWER."

I do not think I should have done my duty to the gentleman who favoured us with the lecture if I had not read this excellent letter of Colonel Bower's. I have nothing more to add, except to ask Major Edwards if he will favour us with any remarks in reply.

Major EDWARDS: I think there has been some misunderstanding as to my views. I do not at all advocate that the Yeomanry force should be converted into mounted infantry; indeed, I thought that I expressed myself very strongly to the contrary. I am sure we are all extremely obliged to General Hamley and Colonel Mussenden for the kind manner in which they have spoken of the force; but I must say I regret to hear from such distinguished authorities that there is, in their opinion, no room for an intermediate force, as it were, between cavalry and infantry. I was in hopes that the Yeomanry might have been converted into a force which, while retaining a great many of the attributes of cavalry, might gain some of those of infantry, and that this might be brought about merely by introducing a good rifle, and making some changes in dress and equipment. Sir Thomas Acland places us in somewhat of a dilemma by saying that if there are only two arms open to us we must give up the idea of making any change at all. I suggest that we should get out of that dilemma by improving our present position. Getting a really good weapon, and altering our drill to a certain extent, would not in any way deteriorate from our present cavalry qualifications. I can corroborate everything Colonel Mussenden has said as to the horses. I have often seen horses under three years old ridden on a 35-mile march, and at a field day the next and following days; it is wonderful how steady they become even during dismounted service. As to the shooting, I am very glad indeed to be able to corroborate what Major Helyar said. My experience of several regiments has shown me that the men are very keen indeed about shooting. In my own regiment the same difficulty occurred as to the quantity of ammunition. We wrote, as Major Helyar did, to the authorities, objecting that only thirty rounds were allowed per man, and to our astonishment we were informed that sixty rounds were allowed; but we never got them, and we have always had to pay for extra ammunition. Captain McGeorge, of the Carbineers, who is Adjutant of the Westmoreland Yeomanry, has just informed me that the figure of merit of that regiment was higher last year than that of any regular cavalry regiment in the Service. So that I think we may look forward with some confidence to the future of the shooting of the Yeomanry. I know in my own regiment men who, living many miles from a range, go and shoot every week regularly. Then, as to tent-pegging, and so on, the men are very keen about it; but we have to buy tent-pegging apparatus, heads and posts, &c., out of our own funds.

Colonel MUSSENDEN: I may state that I applied for this equipment from the Ordnance Storekeeper in the military district, and I was told—what in fact I knew before—that these articles were issued, on authority, to cavalry regiments for the

use of riding schools, but there was no authority to issue them to Yeomanry regiments, unless by special orders from headquarters.

Major EDWARDS: I think if the authorities would supply us with more ammunition, and with the necessary things for tent-pegging, &c., it would be much better for the Yeomanry. A suggestion was made by Major Acland as to the length of time during which men should be called out for permanent duty,—that it should be increased from eight to ten days. I know in one or two regiments that has been done; instead of having eight days' permanent duty and one or two days' preliminary drills, they have now ten days' permanent duty. That is the case in the Leicestershire regiment, and it has been carried out for a great many years in the regiment to which I belong, but we have the preliminary drills in addition. I am very glad to hear Colonel Marsland's remarks upon the value of dismounted service. It is a great encouragement to the auxiliary forces when Officers who have commanded such distinguished regiments as he has done will come forward on occasions of this kind to give us the advantage of their experience. It seems very uphill work to make any suggestion the carrying out of which will cost money; and, therefore, I have not the slightest hopes that my remarks, with reference to the Yeomanry considered as a reserve, will receive any attention whatever. But, with regard to the value of the force as an auxiliary, I think something ought to be done; and if the authorities would entertain these views of mine, which merely amount to this—that the force shall receive a good rifle, that some slight alteration should be made in drill and in dress, and that the sword should be attached in a different way—the result would be that the Yeomanry would become a very valuable force indeed. On the other hand, if they do not, the responsibility must rest with the Government if the force withers away, and ceases to exist.¹

The CHAIRMAN: I think no Officer here will disagree with me for proposing a very warm vote of thanks to Major Edwards for his most excellent lecture. The Yeomanry is a force for which every Englishman has a considerable affection, and I am very sorry to hear that it has withered down. I think it might be made a most valuable force, and though there is little hope of making much impression through the medium of lectures upon people in office, yet perhaps some remarks which have fallen to-day may lead to good hereafter, in which case I think the Yeomanry will owe a very great debt of gratitude to Major Edwards.

¹ NOTE.—With regard to the question of dress, I quite agree with Colonel Mussenden that any change involving expense to Officers, or destruction of *esprit de corps*, would be most objectionable. At the same time the value of the Yeomanry would be so largely increased by the adoption of a general uniform that some steps ought to be directed to secure such a result. If my original suggestion be undesirable I would offer another. Let the present full-dress of regiments be retained for review order, and let an undress uniform, similar to that proposed for the regular army, be worn throughout the force for drill and field day order. The dress might be a light helmet and serge Khakee jacket, over which the present belts would be worn. Officers would be distinguished by badges and belts. The cost of this would be very trifling, and the first issue ought to be made by Government, regiments replacing worn clothing from contingent funds. Boots and breeches, the latter with, if possible, the same coloured stripe throughout the force, ought to be universally adopted. The Winchester-Henry Company would, I believe, supply the necessary number of rifles or carbines for about three pounds apiece. The expense, therefore, of giving the Yeomanry a uniform dress, and an accurate repeating rifle, would be within my estimate of 5*l.* a man.

Friday, April 6, 1883.

ADMIRAL SIR EDWARD G. FANSHAWE, K.C.B., Member of
Council, in the Chair.

THE PROTECTION OF OUR NAVAL BASE IN THE NORTH PACIFIC.

By Major-General J. W. LAURIE, late Deputy Adjutant-General
of Militia, Canada.

WITHOUT going into any elaborate statistics as to the importance of the British trade in the Northern Pacific, I may say that six months' residence on the coast of Western North America confirmed me in the view of the necessity, both moral and material, for the presence of a British squadron in those waters. Many able writers, foremost among them Captain J. C. Colomb, R.M.A., have pointed out the value of this position to the Empire, and every year adds to the strength of the arguments they have adduced. The Canadian Pacific Railway, which has been too often looked upon as a visionary creation, will, at present rate of progress, be completed in 1885, and if but a tithe of the expectations it has aroused are realized, an enormous trade from the so-called Far East will be carried on in British ships, and throughout, over British territory, thus multiplying our responsibilities in that quarter.

Every act points to the intention of Russia to remove her chief naval depôt from the land-locked Euxine and Baltic (where in the time of war her fleets can be held as closely sealed up as if they were actually blockaded in port) to Vladivostock, on what is practically an open coast, whence they can run out as opportunities offer, and work untold mischief before their career could be brought to a close. The experience of the Federal Navy in blockading the southern ports during the War of Secession, and the regularity and system with which the blockade runners passed the cloud of sentinel vessels employed by the North, show that numbers and experience cannot avail to really shut up steamers in harbour on an accessible coast.

It has been objected that Russia is only doing the same as ourselves, advancing the limits of her Empire, and carrying civilization into barbarous regions, and that we have no more reason to feel suspicious at her extension than she might at ours, but the slightest examination will show that our cases are entirely different.

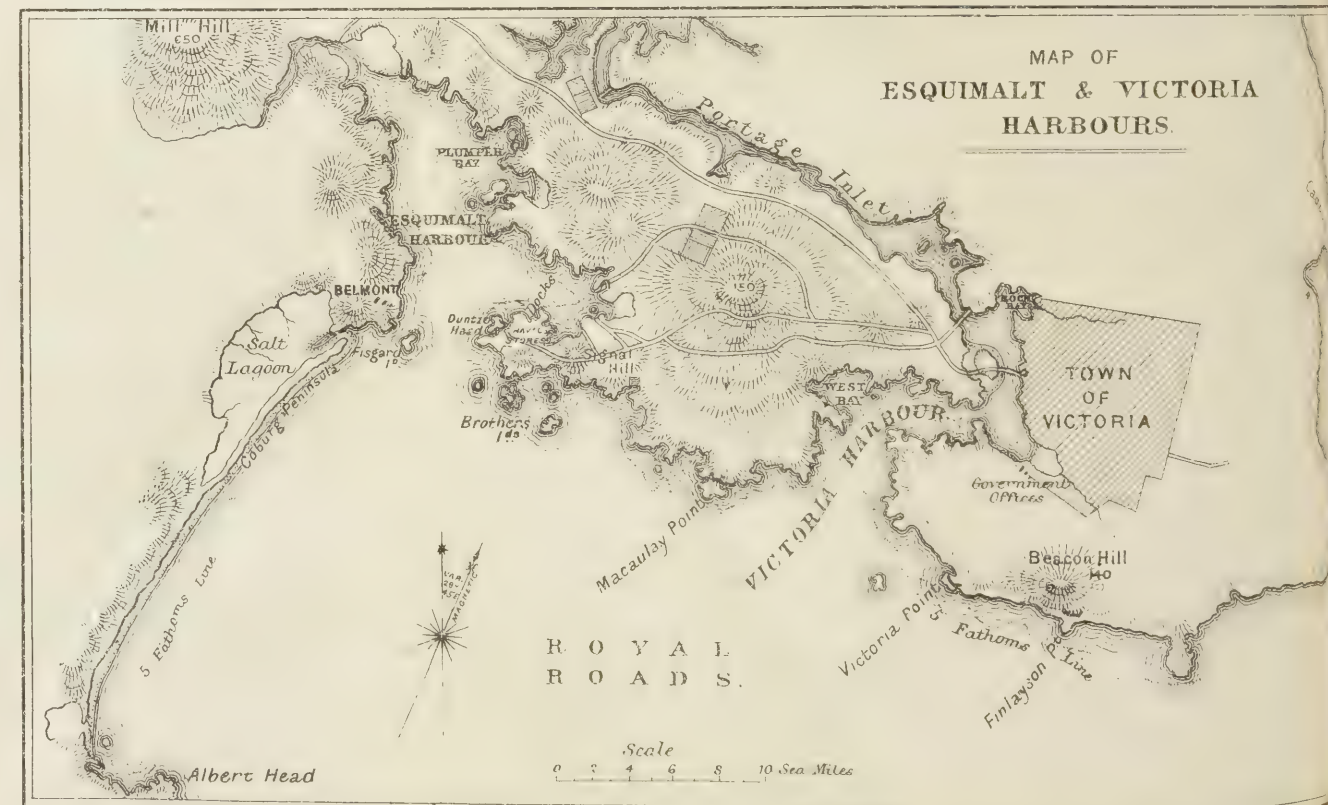
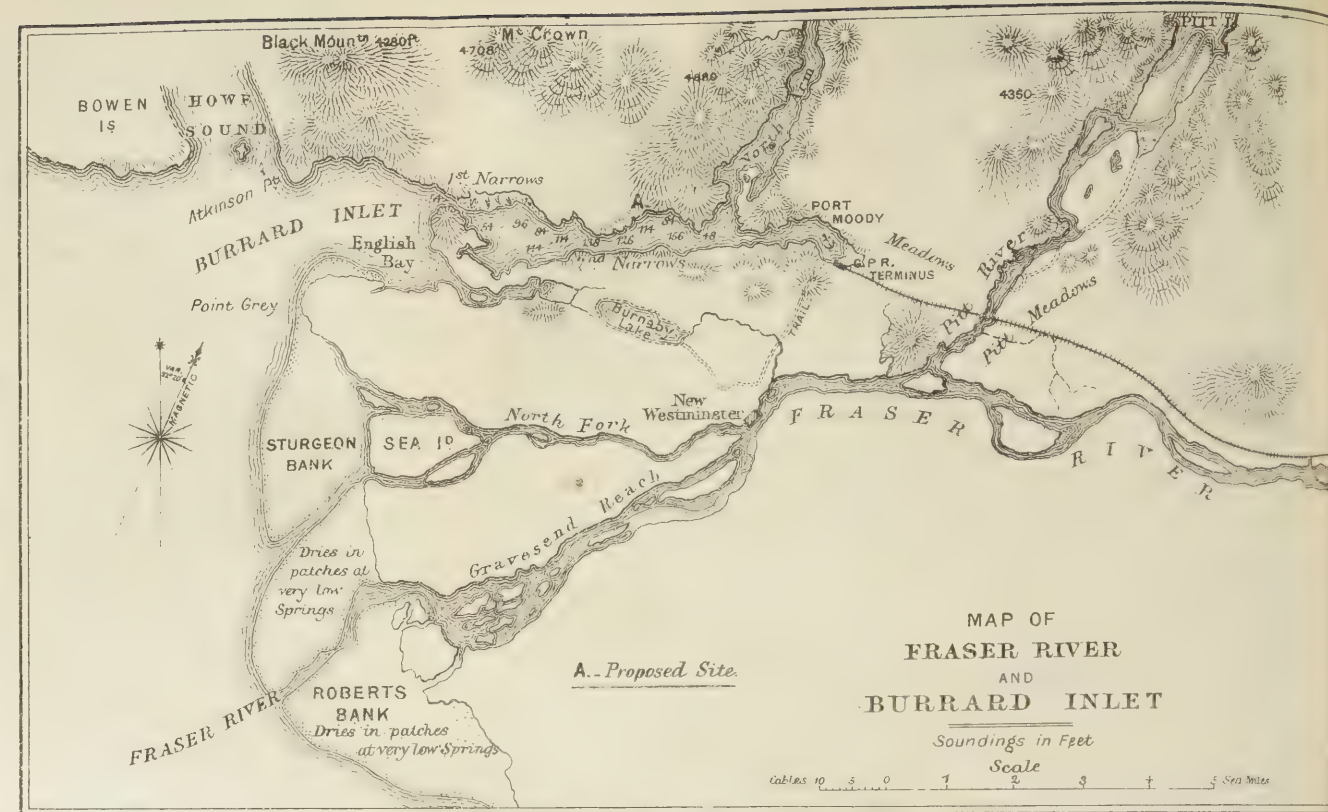
We often describe our increase of empire by the following process : first the missionary, then the trader; and lastly, the man-of-war to

protect the interests thus created; but Russia has struck another line, at least in her settlements in Eastern Asia. There the man-of-war came first, and so far the trader has not followed; in other words, these settlements are exclusively military, and as there is no commerce to require protection, the reason for their existence must be sought elsewhere—not existing for protection, they can only be created for aggression; and the work is done quietly and not with a flourish of trumpets, as if intended to overawe some weak and semi-barbarous Power. It is quite clear that the preparations are not made as against the United States, with whom the relations are studiously gushing, the conclusion therefore forces itself upon one, that but one antagonist is regarded as possible, the only other great Power with large interests and large possessions in that ocean—that is, Great Britain. I am the more confirmed in this, from the tone of the Russian Officers with whom we were brought in contact during a visit paid to Victoria (or rather to Esquimalt) by the Russian flag-ship the “Africa,” one of the converted merchant steamers. We were courteously shown over her, her armament pointed out, the expenses of conversion and strengthening discussed, a small matter of 272,000 dollars, or about 55,000*l.*; she carried guns equivalent to our converted 32-64-prs., and was, of course, stated to be satisfactory, but the whole tenor of the conversation was that she was intended to be used against us; that she was to chase and capture our merchant vessels, but was to run from our smallest fighting ships. She was in every way associated in their minds with a possible, almost a probable, war with “you English,” and decently masked, but hardly concealed, expressions of regret fell from them that war had not resulted, as they felt they were in a position to do us much damage. I stood it for a time, but as we were standing on the quarter-deck of the “Africa,” and this had gone on longer than my patience lasted, I looked up at the ensign, the St. Andrew’s cross, and remarked that it reminded me of old times to see that ensign, I had not seen it since it was flying in the harbour of Sevastopol; a hint that the experiment of a war with us had not turned out well enough to encourage repetition.

Japan and China, too, are emerging from their former state of isolation, and will have to be considered in case of any trouble in that ocean, the more so, as they are becoming owners of powerful iron-clad squadrons.

Chili will more than probably be led by her late successes into an overbearing and high-handed policy; and, as the United States have allowed their navy to fall into a state approaching effacement, the duty of maintaining order on these seas and protecting the rights of neutrals (even if we ourselves do not become principals in a war) devolves on the squadron we maintain on the Pacific Station.

It is outside my province to consider the question whether the force maintained by us in the Eastern Pacific is of sufficient strength for its purposes, but such ships as are there should be thoroughly effective, and one point is clear, that the efficiency of the squadron stationed so far from the home dockyards must largely depend on its





depôt from which it replaces expended stores, and where the ships can refit for further service.

In the days of Nelson, when sails furnished the motive power and smooth-bore guns the armament, an enemy's ship when captured was the not uncommon source of supply from which stores of all sorts were replenished; but in these days of advanced mechanical art, our ships and their armaments are elaborate machines, every part of which must be thoroughly complete, or the machine is not merely crippled, but absolutely unserviceable; and as coal is contraband of war, it is more than ever important that our ships should have a well-stored depôt near at hand, where suitable supplies of every kind, for vessels and guns, as well as coal for engines, should be obtainable; but in time of war we could not retain or obtain these supplies in neutral territory, and there is thus but one place in the Northern Pacific where we have the right to get a ton of coal or keep a pound of gunpowder—that part of Canada known as British Columbia, of which Vancouver's Island politically forms a part, and which happily furnishes an unlimited supply of coal, the best on the Pacific coast.

Esquimalt Naval Yard.

Vancouver's Island on the extreme west of Canada, like Nova Scotia on the far east, is indented with bays, many of which are first-rate harbours; but in establishing a naval depôt, it was of course essential to place it where supplies, such as fresh provisions for the crews, could be readily obtained, and in the then sparsely settled condition of British Columbia, it was not at all unnatural that a suitable harbour as close as possible to Victoria, the centre of population, and the principal market for the produce, not merely of Vancouver's Island, but of the Puget Sound districts of Oregon, should have been selected, and a glance at the map will show it not to be badly placed for the command of Puget Sound; possibly it would have been better situated if altogether outside the straits, as saving six hours in getting fairly to sea, but the navigation of the straits is easy, and vessels generally come up under sail to Royal Roads outside Esquimalt, where the naval yard is situate, well to the south-east part of the island.

The history of this yard affords an amusing instance of how we "drift" in our arrangements. When during the Crimean War the English and French squadrons united for the purpose of making the disastrous attack on Petropaulofski, the then Russian arsenal in the Pacific, our naval authorities obtained the use of a house on a point of land at the entrance of Esquimalt Harbour, and fitted it up as a hospital; from this beginning our naval yard has grown, and in a most unsuitable and exposed place, actually on the spit of land that divides the outside water, the Royal Roads, from the harbour, as if to encourage and invite hostile intentions; and vessels lying in the harbour, instead of in any way being able to cover the dockyard, and protect it with their guns, would have it between them and the assailants, and would actually have to fire over or through the dockyard, in order to assist in its defence.

A dry dock is in progress of construction close by the naval yard, but, at present rate of progress, it will hardly be available for use during the present century, so that the consideration of providing for its protection can hardly be considered a burning question. Esquimalt Bay is so landlocked that it makes a capital harbour, and will accommodate a very fair number of ships; it is situated about 4 miles by road from Victoria, and in fact forms the deep water harbour of the town, as Victoria Harbour is only to be entered by large sea-going ships at high tide, and the mail steamers which leave for distant ports, such as San Francisco, at a fixed hour, start from Esquimalt, where they are independent of tide.

Why Victoria, the capital, which aspires to be a commercial town of the first magnitude, was placed on the comparatively shallow and difficult harbour is a matter that can be best explained by the Hudson Bay Company and its officials; the former had a fort and a trading port there, and business clustered round this, until vested interests, hard to disturb, were created, and it became the seat of Government. For the actual purposes of the ships, Esquimalt in time of peace satisfies, I should think, all the necessary conditions; a good harbour and easy access to stores; with fresh supplies at a reasonable rate; but my duty required me to look upon it in a different light. I had to regard it as a position to be defended in case of war, and with such material as was supplied me, or which, on an emergency, I could improvise.

In accordance with some recommendations made, I believe, by the Colonial Defence Committee of 1878, some batteries were erected by Lieutenant-Colonel Irwin, R.A., who was sent out in that year by the Canadian Government for the purpose; these may be seen on the plan, and are well placed for the purpose of carrying out the instructions he received. In some of our earlier experiences in India, when our troops were sent to attack hill forts, the attack was delivered on the gate, which was found to be carefully fortified, and the attack failed; whilst it was afterwards discovered that the other defences of the fort were so dilapidated, that it would have been possible to have got in anywhere, except at the gate. Now this is pretty much the view I hold of the present defences of Victoria and Esquimalt; if an enemy's cruiser will obligingly attack directly in front, he will find guns mounted to bear on him, but if he will betake himself behind Clover Point or to Ross Bay he can keep out of the way of our guns and destroy Victoria; or, by landing a very moderate party of men, can enter the batteries from the rear, and either spike the guns or tumble them over the bank. I do not say this as criticizing Colonel Irwin's arrangements in any hostile spirit. He was sent out there with certain definite instructions, and a very limited command of money for the work of construction. He found but a small amount of material available, simply some of the small reserve of guns kept at the naval yard to meet the pressing wants of the squadron. He was authorized to raise a battery of Volunteer Militia Artillery, at first fifty men, afterwards increased to eighty-four; he had also to bear in mind that he was spending the money of the Canadian tax-

payer; it was necessary that he should, in appearance at least, take steps to protect the taxpayer's property. If his means did not enable him to block and guard every road by which an enemy could approach Victoria and Esquimalt, he showed good judgment in doing all in his power to guard that which was most easy of approach. An enemy coming to Vancouver's Island must necessarily come across the water, it was at any rate a point gained, that he should not be able to sail unopposed right into either of these harbours.

In 1879, a very able Officer, Colonel Lovell, R.E., was sent by the Imperial Government to report on the defences of British Columbia. His report has not been published, but the instructions he received were also communicated to Lieutenant-Colonel Strange, R.A., who accompanied him, and these and Colonel Strange's report appear in the Canadian Blue Book, and I will quote these instructions.

To report in detail on the following points:—

1. The means to be adopted for placing the harbours of Esquimalt and Victoria in an efficient state of defence by permanent works; the extent to which the temporary works may be made available being reported.

2. Whether the two harbours can be considered independently, or whether, on the other hand, the scheme of defence must necessarily embrace both, bearing in mind that Esquimalt as an Imperial station is of primary importance.

3. The garrison required to be permanently maintained, and the manner in which such garrison should be constituted, stating the extent to which assistance in this respect may be expected from local resources.

In a second letter of the same date Colonel Lovell is requested to visit Nanaimo, as its defence may become a matter of importance on account of its coal supplies. Also is told, that any views he "may form generally, on the measures to be taken for the defence of the Pacific coast of Her Majesty's dominions in the event of war, bearing in mind its distance from any established naval arsenal, and the difficulties which must, therefore, attend hostile operations directed *against it*," will be gladly received by the Secretary of State for War.

A very important alternative was therefore apparently not opened to him, the power of recommending that Esquimalt was practically indefensible with the means at command or likely to be furnished; and that another site equally advantageous as a naval yard, and with capacity for defence, might be substituted.

Colonel Strange very pointedly calls attention to the mistake in the last paragraph of the second War Office letter, as to our possessions on the Pacific coast being so distant from any established naval arsenal as to make hostile operations *against* them very difficult. He points out that the United States not merely have a large Government establishment at and near San Francisco, they also have, immediately available, the resources of that city of 350,000 people, a city, I would point out, whose industries are largely devoted to the provision of machinery for the great mining districts of California, Nevada, and now Arizona, and to the supply and refitting of the enormous com-

mercial shipping that enters the Golden Gate, consequently specially suited to equip a maritime expedition, whilst the overland railway will bring the almost unlimited supplies of men and material of the highly developed Eastern States, in from three to six days' travel, to strengthen an expedition which might be there fitted out. The United States' Government recognizes the importance of San Francisco as a possible base of operations, for although the squadron there is small, indeed but nominal, San Francisco is the military headquarters of the West, and large barracks and strong fortifications show that they recognize the necessity for preparing for eventualities.

I need not again refer to the power that Russia is developing, but only repeat and endorse what Colonel (now General) Strange, in his report, so emphatically points out, that "the difficulties of defence are under present conditions much greater than the facilities for attack, and that the bases of hostile operations are much nearer than is implied in the last paragraph of the letter" I have quoted.

So much for the possibility of the organization of a hostile expedition against Esquimalt. We now have to consider how far it is capable of defence. That the temporary defences erected by Lieut.-Colonel Irwin were not considered sufficient, is proved by the mission of Colonel Lovell, R.E., and later of Colonel Crossman, R.E., and the instructions given to the former. Colonel Lovell's report has not been made public, and I was unfortunate in missing Colonel Crossman, who finished his inspection and left Victoria the evening before I arrived there; I am therefore unable to quote their views, and will only express my own.

I have already pointed out that, in its present position, the naval yard at Esquimalt is very exposed, being but a few hundred yards in the rear of the battery on Brothers Island, the most advanced point on which a gun could be placed; so that any hostile cruiser lying off at such a distance as would expose it to but small risk of injury from the 9-ton gun at Brothers Island, could put shell into the naval yard and utterly destroy it; as it, at extreme ranges, would present a far larger mark than a single small vessel; or, in the event of a nearer approach, one gun could be held in check and its attention occupied, whilst other guns did the required mischief to the dock-yard. It follows clearly, and I think all authorities will support this, that even if Esquimalt were retained as the port, the buildings must be removed, and re-erected at the inner end of the bay. I mention this now, as the question of expense of rebuilding the establishment may cause an objection to my proposition, and this I maintain must in any case be incurred. I need hardly say that I am quite of the opinion, that if works of sufficient strength, and armed with the required guns, are erected on the sea front, no hostile squadron could force its way into the harbour, at least until the guns were overmastered and silenced, and to this contingency every fortress is liable; but even when the front door is made secure, there remains not merely one back door, but the general question of an approach by land from every or any point. The plan will show the weakness of the position. It is not that Esquimalt is vulnerable from one point only, for, if so,

steps might be taken to protect one weak place, but situate on a peninsula, surrounded by bays, it is approachable on all sides. An expedition, large or small, could land anywhere at from one to three hours' march from the dockyard. We know what our young naval Officers, Burgoyne and others, did on the Sea of Azof during the latter part of the Crimean War, how two or three daring men carried fire and destruction to the Russian stores on the road to the Crimea, and these lessons are open to imitation; the whole coast is open for the landing of a daring boat's crew; and for such a work of destruction there is no necessity for a permanent occupation. The depôt produces nothing worth continuous retention, its stores would be of enormous value to our squadron, of comparatively small use to others; it is their destruction, not their appropriation, that an enemy would seek; but if the object were to seize and hold by a stronger force, from Sooke Inlet to the westward, all the way round the coast to Saanich on the north, are bays and beaches, where the flotilla could lie at anchor and an expedition be landed at ease. In the neighbourhood of Sooke the country is not very practicable, being heavily wooded, but troops could work their way through it, if time was not an object; from all other points the country is open and practicable everywhere. It has been suggested that, by abandoning Victoria and fortifying the portage or neck between the head of the north arm of Victoria and Esquimalt harbours, the Esquimalt defence would thereby be made safe; but all the population, all the wealth, and all the resources of Victoria, would at once be abandoned, and the low shore on both sides of Victoria Harbour, and its smooth water, would admit of a force crossing anywhere, even if boats were not obtainable, by rafting material, easily procurable from the buildings in the town, or from the woods which are scattered along the water's edge.

Any site can be fortified, and if not made impregnable, can at least be enabled to hold out for a certain length of time. Engineering skill, and we have, undoubtedly, as able engineers as are to be found in the world, will readily compass this, but it means money to construct and arm, and a strong garrison to be constantly kept up, both to maintain the works in peace time and to defend them during war; a garrison, too, which must here be retained at its war strength, as it is not possible to increase it at short notice from any other part of the Empire.

I am not in the secrets of the authorities, but the conclusion I came to was, that to provide properly for the defences of Esquimalt, would require such an outlay, both in permanent works and subsequent annual charge, that no British Government would listen to it, and that there was therefore little hope that Esquimalt could be made as secure as our solitary naval depôt in those seas should be. The local forces are, of course, enrolled for the defence of Canada, and maintained out of Canadian pockets; and Canadian homes and property have the first right to their services; both public spirit and good policy would, however, lead to their services being at once given for the protection of the British dockyard, but they can only be looked on as auxiliaries; a reserve force to strengthen the garrison, not the

sole defence; and the total available strength that could be furnished is but small.

Taking the proportion of fighting men in a population as 1 in 7, an outside estimate, as I know from long experience, the 16,000 white people of British Columbia would not furnish much over 2,000 men to carry arms, but a portion of these are aliens owning other allegiance, and as the population is scattered over many hundred miles of country, not more than one-third of them could be concentrated at short notice for the defence of such forts as might be proposed; a number quite insufficient to man water lines, extending round Victoria and Esquimalt Harbours and the Isthmus forts; because, however small the attacking force might be, it would have its choice of the point of attack, and as it could be more expeditiously moved by water than the defenders could, with present means of communication, move by land, it could, by judicious feints and occupying the attention of defenders, and so keeping them scattered along the line, have the preponderance of numbers at the actual point of attack.

There is, of course, the alternative that the squadron, or a portion of it, should remain at Esquimalt and act as the garrison and defend its own base, but this hardly requires a second thought. There can be but small object in maintaining an expensive seagoing squadron if it has to remain in harbour to protect its stores; the ships would not serve the purpose for which they were sent to the Pacific Station, and if maintained at all, would be more usefully employed in the British Channel; barracks cost less than ships to maintain, and economy, with equal efficiency, establishes that the garrison must consist of a force on shore which can never be withdrawn on some will-of-the-wisp expedition, and will thus leave the naval commander perfectly free to use the whole of his ships on the high seas for the attack of the enemy's coast or the protection of our own.

Nanaimo Coal Supply.

But even supposing that Esquimalt were satisfactorily occupied and defended, the most important of our requirements would still be at an enemy's mercy. Nanaimo, to which Colonel Lovell's attention was directed as the source of our coal supply, would not be protected from hostile attack unless independent works were provided. An expedition launched against it from the Puget Sound ports would not have to pass Esquimalt, and, even if notice of appearance of the expedition were sent to the vessels stationed there, they would but arrive in time to witness the destruction consummated, not to prevent it. With the shipping piers, &c., at Nanaimo destroyed, our vessels would be dependent on sail power—a pleasing condition for our mercantile, as well as our militant, marine. Of course, coal could be stored in quantities under the guns at Esquimalt, but the supply could only be limited, considering risk of loss, certainty of deterioration, and enormous increase of expense; it is therefore in all respects desirable to maintain Nanaimo rather than Esquimalt as our coaling depôt, where the supply would be cheaper and practically inex-

haustible. But it is also important to prevent an enemy not merely stopping *our* obtaining coal from Nanaimo, but obtaining possession and holding it as a source of supply for his own ships. A garrison shut up in Esquimalt would hardly guard against this, and the vessels there, as stated, could not readily prevent it. I may incidentally mention, that the managing owner of the Wellington Colliery at Nanaimo, *that* from which the largest portion of the coal is mined, Mr. A. Dunsmuir, is a most liberal and public-spirited Scotchman, and if his sympathies were enlisted, by giving him some official connection with the defensive organization, I believe that a very moderate outlay would put the coaling station in a position to resist any isolated attack.

Canadian Pacific Railway Terminus.

Next to the importance of protecting the coaling station, on which I have not dwelt at the length its importance deserves, because I conceive this is patent to all, comes the new question of protecting the terminus of the railway which in two years from the present time will be an accomplished fact; a railway which will no longer leave British Columbia an isolated province, with its communication with the rest of the Empire only through an alien territory or by a long and circuitous ocean voyage. In 1885 we are promised that the Canadian Pacific Railway will be open from end to end. In six days from Montreal, in thirteen days from Liverpool, we shall be able to reach the Pacific. I may be told this destroys my argument as to the necessity of maintaining a naval depôt on the coast, but to my mind it rather increases the importance of the station, as it puts us in a better case to take up the best defensive position, the offensive-defensive, to fit out and strike from there, to defend our coasts and our commerce by as much as possible carrying the war with all its disagreeables on to the enemy's coast and positions. In any case the railway terminus *must* be adequately protected; the large through trade that is certain to follow the completion of this route will bring an enormous mercantile marine into these waters, and it will be of prime necessity that there should be a position under our own guns where they can shelter, and whence they can work in concert with our men-of-war, who may be charged to protect them. A large mercantile harbour, such as Burrard Inlet, the proposed terminus of the railway, must be, if left without defences, can only be likened to a huge rat-trap into which our vessels would all be gathered, so as to fall the more readily into the hands of an enterprising enemy, and save him the trouble of hunting them down one by one on the high seas.

We thus, by retaining Esquimalt as our naval station, expose ourselves to one of the two alternatives, for by leaving it in its present open and unprotected state, it is certain to be destroyed at the outbreak of a war, or by undertaking a very heavy charge in permanent works and garrison, we put it in a comparatively defensible state, but we leave our coal and railway communications unguarded and exposed, or must again at a large expenditure provide for the protection of each of these. We thus fritter away our force in

attempting to guard three points, on each of which an enemy could practically concentrate his whole strength, and so destroy our position in detail.

It is from consideration of all this that I am led to recommend that our naval depôt at Esquimalt be abandoned, and that one be established at Burrard Inlet. We are thus enabled to concentrate our available means of defence, making *that* the centre of our position; it is placed immediately opposite to Nanaimo, and can thus much more readily render assistance to that point than could be given from Esquimalt. In fact, an expedition coming from the south against Nanaimo could be observed, and met on the Straits of Georgia by ships from Burrard Inlet, whilst, as already mentioned, vessels from Esquimalt could only arrive after the mischief was done. Any protecting works considered necessary at Nanaimo could for these reasons be on a smaller scale, as assistance could be obtained so much more quickly.

Future of Victoria.

It may be objected that it will be unwise to leave Victoria entirely exposed and undefended, that it would be bad policy to, as it were, abandon Victoria, with all its wealth and commercial interests, the more especially as it is the seat of the Government of the Province; that great irritation would be caused and bitter feelings aroused in this, the largest community and from which the public sentiment of the Province largely takes its tone. I am aware that prejudices will be aroused, and in such a loyal community and one so thoroughly British in sentiment as that of Victoria, I would be most unwilling to create any soreness, but I believe that what I recommend is for the true interest of the people of Victoria themselves.

A few enthusiasts believe that the goods in transit over the Canadian Pacific Railway will be transhipped at Victoria, and thus it will be actually the terminus of the ocean trade. I can see no grounds for this view; ocean steamers pass to Nanaimo now for coal, and Burrard Inlet was selected as the terminus of the Pacific Railway on the strength of evidence to which I shall presently allude, as the most suitable place for carrying on through traffic, on account of its accessibility for ocean-going steamers; hence I conclude that the traffic will centre at the harbour in which the terminus is placed, and no transshipment will take place.

Victoria will then depend mainly on the trade of the coast and of its own neighbourhood; a trade that will unquestionably largely increase as the Province fills up and the fisheries, mines, and milling interests are developed, and will make it a place of considerable importance, but it has in my opinion a brighter future before it beyond its commercial prospects. It has a charming and very equable climate, the thermometer not registering above 74° in the shade in August, and only two or three degrees of frost in January; these are the extremes of temperature usually experienced, and old settlers say they never saw snow there, until after the Colony joined the Canadian Dominion, and thus, they think, acquired Canadian weather.

The air is most invigorating, very pure, largely, it is said, owing to the presence of large quantities of snow on the Olympian Range, just across the Straits of San Juan de Fuca; these mountains show their northerly slopes to Victoria, they run up to over 8,000 feet in height, and the snow-line on this northerly exposure is about 4,000 feet above the sea-level, and the light and shadow caused by the early morning or late afternoon sun, when it gets well to the north, on the deep and sharply-cut valleys and successive ridges, present one of the most beautiful pictures nature has ever painted, and one does not wonder that H.R.H. the Princess Louise could hardly tear herself away from such a lovely scene.

The country in the neighbourhood of Victoria is park-like—scattered oaks and open glades of grass—the ground very broken, but accessible everywhere, quite different from the mainland, where the mountains are bold and often impassable; the woods are full of game, the rivers of fish, and the various channels that surround the island form a perfect paradise for a yachtsman.

Everything points to Victoria and its neighbourhood becoming, what I must style, for want of a better name, the playground of the Pacific coast.

The cold damp winds coming in off the Pacific drive the residents of San Francisco, far to the south as it is, out of town even in the month of July, to get *warm*, whilst in the interior of California the summer heat is great; the coast from the Golden Gate to the Columbia River is almost inaccessible. Oregon and Washington Territory are growing fast in wealth and population, but the seaports are unhealthy, and the interior is hot in summer, and cold in winter, and from both extremes the people of means try to escape. Victoria offers them all they ask; the society, largely fed from University graduates and retired army and navy men, is very pleasant, and all who visit it once long to return; the number of visitors increases yearly, and where business does not take men eastward, I believe that, for people of means, in the great territories west of the Rocky Mountains, Victoria will be the point for which holiday seekers will make; the Isle of Wight of the Pacific with the immense advantage of having a summer and winter season; the pleasure ground of a large and wealthy population, who work hard to acquire, for the purpose of spending liberally in the pursuit of enjoyment.

I do not think Victoria will become less English in consequence of this future, but it will be of less importance for its prosperity that it should retain the naval station at Esquimalt; in fact, I go further, and hold the opinion that it is better for its own interests that Victoria should be an open town, than be included within the scope of a line of defence containing the naval arsenal. As such it would of course be open to destruction by an enemy as a portion of the system of defence, but the tendency of modern warfare has been to leave uninjured, open and undefended towns, unless they can be looked upon as the sources of supply of contraband of war. Odessa was a case in point in the Black Sea in 1854; and in the Crimea, whilst we set ourselves to destroy the military port of Sevastopol, and all the

Government buildings, we did not even make a demonstration against Yalta, equally Government property, but recognized as not utilized for warlike purposes, and therefore looked on as exempt.

Undoubtedly prospective booty, such as the wealth of Victoria, would invite raids from marauders, who would assume the position of belligerents, even if not directly sanctioned by a hostile Government; against such, the inhabitants must be organized to protect themselves, and for this purpose a development of the present organization of the local forces would suffice. Artillery, not tied down to guns mounted in a fixed position, which can be taken in reverse and rendered useless, but what I recommended over and over again as the best defence for the outlying districts of Nova Scotia—guns of position, such as 40-pr. Armstrongs, which (unlike fixed garrison guns, instead of being constantly exposed to decay and destruction from weather, and so costing heavily annually for maintenance of batteries and platforms, as well as painting of carriages and lacquering guns) can be stored in a shed, and only brought out when required for drill or practice, or service, and which can be drawn by farm horses, or teams of oxen, to the point where an attack is actually threatened, and can be advanced or retired for continuous use, and supported by parties of infantry, whom they in their turn will strengthen, and enable to choose their position for attack and defence, whereas with stationary guns the supporting force must think rather of the guns than of any independent action it may desire. Such an equipment of the present force would render it better able to protect Victoria under the conditions I have named, and would not invite an attack on the grounds that it was a depôt of warlike stores.

Navigation of the Straits of Haro.

It may be urged that the Straits of San Juan and Haro are difficult of navigation, and that a crippled vessel would find it difficult to reach Burrard Inlet through the archipelago which intervenes before the Gulf of Georgia is reached; undoubtedly it would be more convenient if these islands did not occupy so much of the channel, but we have to deal with the case as we find it.

The selection of Esquimalt as a naval station was made, and wisely made, when sails were the principal motive power of our men-of-war, and the time required for working under sail through these straits was a matter to be seriously considered, but with steam power the case is materially altered. In 1876 the Government of Canada addressed an official communication to the Admiralty, through their engineer, Mr. Sandford Fleming, requesting to be furnished with the fullest information as to the harbours on the coast of British Columbia and their approaches from the seaward; and Mr. Fleming, not getting from the charts and reports at first furnished such information as he desired, in order that the Government might come to some decision as to the terminus of the Pacific Railway, prepared a memorandum, and a series of twenty-eight questions; in the former he pointed out that, although the railway was to open up and develop the country, still, as no local traffic at present existed, it was important

to give due consideration to through trade, and to select such a terminus as would give the greatest facilities for competing successfully with foreign routes for ocean-borne traffic. This opened the door to the recommendation of any harbour between the 49th and 55th parallel.

The Admiralty, according to the official letter forwarded to the Colonial Office, obtained answers to this memorandum, and these questions, from the "naval Officers who, in their Lordships' opinion, were most likely to be able to give useful information on the subject," viz., Vice-Admiral Hon. A. A. Cochrane, Rear-Admiral C. H. Richards, Vice-Admiral Farquhar, Captain R. P. Cator, Captain W. Graham, Staff-Commander Pender, and Lieutenant W. Collins.

The greater portion of the questions related, first, to the distances from the coast of Asia to the several entrances to channels between the islands and the mainland, next to the distance from each channel to seven of the harbours of the mainland, selected as offering the greatest advantages as well as accessibility by land, also to the anchorages in and around those harbours; but the last two questions, which I give in full, convey the gist of the whole matter.

Q. 27. Mention any special advantages or disadvantages appertaining to any of the seven inlets herein alluded to, which have not been touched upon in the foregoing questions, and give replies thereto.

Q. 28. Having regard to naval and commercial considerations, mention the point on the coast which appears to you the most suitable for the railway terminus, and designate the other points to which reference has herein been made in the order of preference.

Admiral Cochrane considers "Burrard Inlet offers the greatest advantages, although he thinks, in the future, when the country is developed, the terminus will be transferred further north."

Admiral Richards says, in a nautical point of view, "Burrard Inlet is in every way preferable," and he "gives a preference to Fuca Straits over the other channels."

Admiral Farquhar says, "Burrard Inlet is at no great distance from a wide channel, has a deep clear entrance, possesses a splendid harbour, and a fair anchorage outside, and is almost immediately opposite Nanaimo, the great coal depôt, and, if practicable for the railway, he would give the preference to Burrard Inlet."

Captain Graham and Lieutenant Collins do not answer either of these questions.

Captain Cator considers Burrard Inlet as too near the frontier for a railway terminus, and the entrance through the Haro Straits as unsatisfactory, on account of the possession of the Island of San Juan by the United States, but a reference to Captain Cator's evidence shows that he is under the impression that a vessel going up our waters must pass within $2\frac{1}{2}$ miles of San Juan, a view which is not borne out by other professional evidence.

Staff-Commander Pender considers that Burrard Inlet, with its anchorages, is of the greatest value and preferable to all others as being also the most easy of access from the ocean, although the risk

of navigating large steamers against time is to him very great. "He also considers the southern approach to the mainland to be so well defined, charted, and lighted, as to be made present use of by any class of ships."

The preference being thus almost universally given to Burrard Inlet, for even Captain Cator's only objection was its proximity to the United States' boundary, we now examine the remainder of the questions only as bearing on the approach to Burrard Islet, and find that ocean-going *sailing* ships require to be towed about 70 miles from Race Rocks outside the entrance to the Straits of Haro, to the entrance of Burrard Inlet, or 90 miles to Port Moody: in other words, that steam power must be depended on by our vessels for this distance; for such a short distance, and so close to port, auxiliary power, in the shape of dockyard steamers, might certainly be provided in war time, to help crippled ships, or as there will certainly be an increased sailing trade on this route, dependence might reasonably be placed on the commercial community, who are sure to maintain tugs which can be hired or requisitioned.

The most important consideration must, however, be given to the opinions given, as answers in reply to Questions 7 and 8, as to whether, in the event of hostilities with the United States, the course of vessels would be so exposed as to render the approach to Burrard Inlet difficult or hazardous; and at what minimum distance they must pass San Juan or other points of United States' territory.

All agree that, if the Americans have command of the sea, the approach will be hazardous; that, of course, is undoubted; our squadron is there to maintain the command of the sea, not merely to pop in and out like a rabbit out of a burrow, but the larger question is, to my mind, whether, if *we* retain the command of the *sea*, *we* can pass in and out?

Captain Graham says that we must pass within about $4\frac{1}{2}$ miles of San Juan, Captain Cator, speaking from memory, says $2\frac{1}{2}$ miles, and that is true of the passage generally used, which, as Admiral Farquhar says, is commanded by the bluff on the northern end of San Juan, if armed with heavy guns; but there is a passage much nearer to our coast, which, as mentioned by Admiral Cochrane and Commander Pender, takes ships past San Juan at a distance of 5 nautical miles.

I never like to discuss the question of war between ourselves and the people of the United States; we are too much alike, come from the same stock, speak the same language, and are engaged in working out the same results; but there is another matter in connection with this San Juan question which should not be forgotten. The mere fact of a piece of territory belonging to another Power does not, in time of war, imply that that Power *must* retain possession of it. A battery of heavy guns at San Juan must remain *effective* to be a menace; it must be superior in metal to the ships, else it can surely be dealt with and silenced; it must be guarded by a force on land superior to any that can be sent ashore from the squadron; no naval commander would leave a battery on his flank and slink past it,

unless it were so much more powerful that he could not attack it with a reasonable prospect of success. He might not be able to retain possession, but he could perhaps hold it long enough to throw the guns over the bluff, rendering them incapable of further mischief.

If the land force for the protection of the battery were strong enough to prevent our landing and destroying it, in fact strong enough to hold it against any force that we could bring against it, this same land force would be strong enough to overpower us in our own territory, and it follows, not that it would be undesirable to move our base to Burrard Inlet, but that it would be madness to keep it at Esquimalt; where, indeed, we could not keep it, because the settled portion of Vancouver Island and all our supplies would be at once taken from us, and either destroyed or held.

In a comparatively impregnable position at Burrard Inlet, we should at least have our stores safe, our coal depôt guarded, and our railway terminus protected, until we obtained reinforcements; and our vessels, if they could not sail boldly past San Juan, could at least find their way in and out, with comparatively little risk, at a distance of 5 miles from the American guns.

It should also be borne in mind that our burrow has a back entrance, not one that a hostile cruiser, coming in a hurry and with every probability of having to leave in the same way, would care to use; it is difficult, and, when pressed for time, may be called dangerous, but our own ships, knowing the channel well and taking their time, could use it on an emergency, even if it is not all that could be desired. I mean they could enter or leave by the middle channel between Vancouver Island and Queen Charlotte Island, passing down through the middle channel between Vancouver Island and the mainland.

The Canadian Government, after considering all the evidence that could be obtained, decided to make Burrard Inlet the ocean terminus of their through railway, and where mail steamers running against time can navigate, it is but fair to believe that our men-of-war can pass.

In the map I have shown six-fathom soundings through the Haro Straits, and, intricate as the navigation may be, it seems perfectly practicable, although of course the water is deeper, and course more open in mid-channel. Assuming then that it is perfectly practicable for our ships to approach Burrard Inlet, we now come to the question, "What advantages it offers."

Burrard Inlet.

The enlargement of the Admiralty Chart shown gives an idea of the capacity of the harbour, which is nearly 20 miles in length; the entrance is narrow, a few hundred yards wide, making it perfectly landlocked; inside there is room for the whole navy of Great Britain; good anchorage at Port Hastings, where there is a large milling establishment, and large fish oil works; again good anchorage at Moodyville, a large steam mill (to be distinguished from Port Moody, the latter being named after Colonel Moody, R.E., the first Governor of British Columbia, the mill being called after one of the partners, an

American from Maine, who originally established it). On account of the enormous water area of the harbour and North Arm, at a full ebb and flow the tide runs with great speed through the narrows at the entrance, also through the second narrows, but not to the extent often represented. I have passed through both in a lightly engined steam launch against the full head of the tide, and certainly any full powered steamer could do so, or if it were necessary from any cause to wait till the tide slackens, there is magnificent anchorage in English Bay, immediately outside the entrance.

Immediately inside the second narrows on the north shore of the Inlet is a most eligible site (from a defensive point of view) for a naval yard. The anchorage is reported good in front; on its left flank, or eastern side, is the cliff-bound fiord, known as the North Arm, inaccessible to boats either to embark or to land; in rear is a range of mountains which may be considered quite impassable for any body of armed men; to the westward the cliffs rise up hundreds of feet sheer from the water on Howe Sound, making landing virtually impossible; and the country between Point Atkinson and the entrance to the Inlet is so rugged and wild that armed men, with the most ordinary equipment, could not make way through it; it is therefore only accessible from the front, and this must be by water either through the narrow entrance or across the Inlet.

The outer narrows are but a few hundred yards wide, commanded on the south by a high bluff, from which guns could bear both on vessels coming up from outside, and on any that might have run the gauntlet and be passing up the harbour. Two low points on the north side offer desirable positions for batteries to deal with vessels attempting to run close in under the south bluff. Long-range guns on Points Grey and Atkinson would, if deemed necessary, protect the outside anchorage, and form an additional obstacle to vessels coming in from seaward.

An enemy coming across the 49th parallel and desiring to reach Burrard Inlet, would first have to cross the Fraser River, and would be actually limited to that portion of it between the junction of the Pitt River and the delta of the Fraser; boats or canoes could, of course, be brought by teams from the boundary to any point on the Fraser, and an expedition could be embarked; but on the spit of land between the Fraser and the Pitt, transport for boats could not be obtained, and the undergrowth would almost bar the passage to an armed party: descending the Fraser and ascending the Pitt, the Pitt meadows, which are a deep swamp, would bar advance towards Port Moody. The railway to be carried across these meadows would be the only road by which the Inlet could be approached in that direction, and on such a narrow front a few men would hold out against a much larger force, or the railway here, which will probably be a viaduct, could be rendered impassable at this point. Below New Westminster the river separates into four arms, and if the first were passed, the boats could not be carried across the intervening islands, and even if the brush on the low islands were passed, the next arm would prove an impassable obstacle. There are

at present but two roads from the Fraser to the Inlet, and these both pass through New Westminster, which is therefore the key of the position, and the organized force of that city, supported by light guns, would make it very hot for an expedition coming down the Fraser to land at this point, and if the landing were effected, our troops could take up a series of defensive positions on the road to the Inlet, as the forest growth is too thick to allow of any flanking movement; whilst, even if successful in fighting their way to the water's edge, the enemy would still find the harbour between them and the dockyard, and be without any means of crossing.

My proposed naval dépôt will be but thirty hours by rail from the fertile plains and great food-producing districts of the Saskatchewan, with which it will of course be in direct telegraphic communication, and as these territories are being rapidly peopled, they would pour down, not merely supplies, but reinforcements of men to assist in repelling any attack in force, an aid that could not be furnished to Esquimalt if our garrison there were attacked, and we had temporarily lost the command of the sea during the absence of our squadron.

Our position would be materially strengthened by shortening the line of communication with our original base, England, and our intermediate base, Eastern Canada, and by establishing our main place of arms at the most vulnerable point, where everything must be transhipped if Esquimalt is to be retained.

I have endeavoured to show the advantages of my proposition; I have not sought to minimize the objections; I conceive it to be an Imperial question, but one in which Canada as an integral and increasingly important portion of the Empire is much interested, and, as an Imperial Officer, whose service has been largely with our Canadian comrades in arms, I have felt it was not out of place that I should bring forward this subject for serious consideration.

Captain CURTIS, R.N.: It seems to me that there are two points which are of importance in relation to this subject. The first is, that we should be able to blockade both inlets with our fleet; for unless we can do that, I do not think we should be able to hold our own in that neighbourhood; and the second point is, that I should like to know whether, if the line shown on the map be a neutral line, any nation at war with us but at peace with the United States would be able to come up within that line without our attacking them? I know some little about Burrard's Inlet. Mr. Pearce, the late Surveyor-General of North-West British Columbia, happens to have an oil factory there, though it unfortunately had to partially stop on account of the difficulty with regard to drying the fish-scrap or manure. They are obliged to empty a great part of the fish-scrap back again into the sea after extracting the oil. From what I know of the place I think that what General Laurie has said with respect to transferring the base of our naval position to Burrard's Inlet is of very great importance, and close in shore, I believe, there is any amount of water for our fleet. My friend has a pier running out there. He only has to run the net out and haul it in again, and he can catch any amount of fish. I may also say that there is coal at Burrard's Inlet. 200 miles of coal have been discovered on the Canadian Railway, in the Saskatchewan district up to the Rocky Mountains, and that is a very important point, because coal could come down that railway to Burrard's Inlet, and that would put Nanaimo out of the running altogether. The two points, however, which I principally wish to impress are, that we ought to be able to blockade both inlets with our fleet, and also I should

like to know whether the enemy could come up within this line, between the line as defined on the plan, and the American coast.¹

C. PFOUNDEN, F.R.G.S., &c.: There is an important point that has only been briefly alluded to in this paper which I desire to say just a few words upon, and that is "Our relations with China and Japan." The chart exhibited being on the Mercator scale, to others than those who are accustomed to use that scale, it naturally very much distorts the northern portion of the Pacific, and we do not get a fair estimate of the very short distance from the Russian territory to our own of the Pacific coast. From knowledge gained during long residence in China, and especially in Japan, I think our connection with this latter country should be looked to as a most vitally momentous matter. I know, also, that many are very much more in favour of the Chinese, and the idea prevails that in certain parts of China a very much better class of men than we have can be found to act as seamen and firemen. At the same time, I think, some bond of unity with Japan, if our authorities could see fit to enter into a treaty of offence and defence against the Russians, would be of immense advantage. I have had very varied and not inconsiderable experience of all classes of the Japanese, and I believe they would make splendid auxiliaries, or allies, both ashore and afloat. A recent paper in the *Nineteenth Century* sounded a note of warning with regard to the weakness of our army; and I had the honour of reading a paper, with regard to our seamen, &c., at the British Association last year. I think that such a treaty would be of very great advantage, especially when we look at the geographical and political position of that country with regard to our North American territory. The Japanese would be very much more valuable allies than is generally supposed, having ample docks, machinery, &c., at disposal. I saw some 9,000 of our Gallic neighbours across the water in "durance vile" under the walls of Minden in 1870-71, and from what I saw during the struggle between France and Germany I am of opinion that we could get an equally valuable contingent of allies from the Japanese, who would be quite capable of giving good account of such a class of troops, should we ever be in trouble. I merely throw that hint out as an illustration of my opinion with regard to the value of the Japanese afloat or on shore. I know for myself what discipline they can be brought under, judging from how easily I managed them, single-handed, when getting them off in our own and chartered ships for the Formosan expedition, and what they can endure in the field, and with regard to bravery, cool courage, and dash, and everything that is necessary in the face of an enemy. Then we have to consider, also, the fact that Japan is a nation of nearly 40,000,000 of people, who have at their disposal, at the present moment, very valuable resources that we ought not to allow the risk of falling into the hands of an enemy; they have most important machinery, several large and well appointed docks and arsenals, and appliances at their command, and are likely to have some of still more importance, so that if we will only protect them from the Russians the day may come when they will be very valuable to us. I think by such an alliance, offensive and defensive, with the Japanese we should find an important and very economical way of almost immediately providing a very valuable base in the Pacific, while something else is being done in our own territories. It is hoping to draw attention to these matters and to "strike a key-note of warning" that I have ventured to intrude on the meeting, and to point out as one of the most valuable considerations for immediate study, that in case we are brought into contact with the Russians, or any other Power, or combination of smaller Powers, it is to the Japanese, rather than to the Chinese, that I think we must look for practical and immediate assistance, or rather co-operation for mutual defence.

Mr. BRYCE, M.P.: I may perhaps be permitted by the meeting to say a word or two, on the ground that I am one of the few here present who have visited the places treated of by General Laurie. About eighteen months ago I was at Victoria

¹ NOTE.—The capture of Kinburn, Kutch, and Yenekali confirms the views of Major-General Laurie, Kinburn, chiefly taken in rear, Kutch and Yenekali taken in rear, the allies landing in a bay to the southward. The garrison escaped capture by retreating into the interior.

and Esquimalt, and therefore I may perhaps contribute a little to the information of the meeting. May I be permitted first to say that I very much admire the lucidity and force with which General Laurie has stated his case, and so far as my own observations go, I willingly bear testimony to the practical correctness of the account he has given both of Victoria and of Esquimalt? I quite agree with his view that Victoria and all that part of our dominions is rather to be looked upon as the pleasure ground of the Pacific coast, than as a region of great commercial importance. Anyone who sails from Vancouver's Island, as far south as San Francisco, and still further down to Old California, and observes how wonderfully exposed and wild all that long line of coast is, a coast almost destitute of harbours, and swept by frequent storms, will be struck with the fact, that when this part of the world becomes filled by an industrious and wealthy population, who will wish and will be able to afford to enjoy also the pleasures of life, the region to which they will resort for summer enjoyment will be the further end of Vancouver's Island and the inlets which form part of or issue from Puget Sound. The whole of that coast displays one of the most beautiful pieces of scenery that the world possesses. There are islands of various heights and sizes, generally richly wooded, furnishing admirable sites for villas and watering places; and the great stores of natural wealth which exist in the State of Oregon and Washington Territory warrant the belief that in thirty or forty years there will probably be a vast population living within easy reach of the coast; so that we may well expect that the number of pleasure seekers in that part of the world will be very great. From its situation and climate Victoria will be a spot specially attractive to summer visitors generally, as well as to those yachtmen to whom General Laurie has referred; and it may become the Brighton or Torquay of the Northern Pacific. As regards the military or commercial future of Victoria, considering the extreme difficulty of protecting Esquimalt Harbour and the town of Victoria, and looking to the shallowness of the water, it is clear that it never will become a place of great strength or of great trade. Perhaps it really would be for the benefit of Victoria that the naval station should be removed from Esquimalt, and Victoria be permitted to extend itself over the inlet which separates it from Esquimalt, so that Esquimalt Inlet should become the commercial harbour. It is much better fitted for the purpose than the present port of Victoria. I conceive in that way a better future will be opened commercially to Victoria than it can aspire to at present, and at the same time it would have the advantage of being an open town and not liable to bombardment in case of war. The question of what would happen in case of war with the United States is fortunately a question which may be regarded as purely theoretical, because any Englishman who travels in the United States feels as certain as one can be of anything in the future, that hostilities between that country and ourselves are practically impossible; of course there are other Powers in the Pacific of which one cannot say so much. At the same time, I do not think we need feel any fear of such a contingency. Knowing something of the naval condition of these Powers, I feel perfectly certain that our navy could give a good account of them before they could reach this harbour. I have not seen Burrard's Inlet; but all that I have heard of it confirms the conclusion maintained in General Laurie's paper—that the best point for our naval stronghold would be that which is nearest to the terminus of the Canadian Pacific Railway.

Captain BEDFORD PIM, R.N.: Having spent several of the happiest days of my life in that neighbourhood, on board the old "Herald," I naturally take a very great interest in it now, and I take an interest in it not alone for that reason, but because I believe it is, strategically, of the very utmost importance to this country. I was very much struck with the concluding words of the gallant lecturer, in which he said that this question was a really Imperial one; and I must confess that I have never listened to any paper in this room more admirable than that of General Laurie. It is thoroughly well put together, and it breathes a good old-fashioned Tory principle from end to end, in a way such as I must confess has warmed my heart. I was very glad to find the gallant General has put his observations upon paper in such a strain as he has done. With regard to moving the strategical point from Esquimalt to Burrard's Inlet, I am hardly prepared to go with him there. I think that some of the ironclads that we have in our harbours, that are

not able to keep the sea, might very well be used at Esquimalt and Nanaimo, and also Burrard's Inlet if you like. I think that they will do all the work that is necessary to keep any one from landing. I quite agree that the position of the forts is simply absurd; we cannot call them forts at all. As the General pointed out, you will have to fire through the dockyard before you can touch an enemy approaching; that would be done away with if you had an ironclad there and used it for the purpose of defence, and also at Nanaimo. Burrard's Inlet seems to have admirable advantages for the terminus of the railway. I believe Sir Alexander Galt will tell us presently that the railway will be completed in 1885. I have a letter from the President of the Canadian Pacific Railway (who is going to show all sorts of hospitality to the British Association next year) in which he says that it will be, at all events, to the foot of the Rocky Mountains before that time. In relation to the transit itself through Canada, I may mention one point which the gallant General has not referred to, and that is this: that I think there will be a great deal more commerce go by way of that terminus than he has the least idea of. I hold in my hand a letter written to me so long ago as the year 1866, from the famous Commodore Maury, and he says if the line to China is continued on the great circle from San Francisco and back to Vancouver, you would take the winds with you both ways, and make extraordinarily rapid passages. Under those circumstances no doubt our communication with India and China will go by way of America instead of through the Suez Canal. It will be made very much quicker by simply having an outgoing route and an incoming route, because you carry favourable winds with you both ways. I remember taking special interest in this part of the world some years ago. I think it was in February, 1877, that I brought a question before the House of Commons with regard to eleven Russian vessels which were then lying in San Francisco Harbour, evidently sent there not for the purpose of attacking Turkish merchant ships or men-of-war, but to be ready, in the event of war being declared with us, to cut off our food supply. I dare say every lady and gentleman in this room knows that we get two-thirds of our food from abroad: and from San Francisco last year upwards of a million tons, not quarters, of grain came to this country. With light and active cruizers nothing could be easier than to cut that supply. Captain Semmes played havoc with the American merchant navy, and we all know it is very easy and simple to do the same with ours. We really have not the command of the sea at all unless we have fast and efficient cruizers ready to keep that command. Our ironclads, to my mind, are not worth much, and as to any cruizer that can convoy a number of merchant ships round Cape Horn, I do not know of one on the "Navy List" at the present moment. I think I have said sufficient to show that the paper of the gallant General is a most well-timed and useful one, and one that I am quite sure deserves the warmest thanks of this Institution. It is one really of Imperial interest. For my part, my only astonishment is that Canada sticks to us. I wonder that she does not throw us overboard at once; because if Vancouver and the terminus of the Canada Pacific Railway were attacked by only one small, active, light-draught vessel, it would play havoc with those different settlements, and who would have to pay the piper? Of course the Canadians. They would lose prestige, and altogether it would be a very bad thing for them. I hope that this discussion will prove to be a note of warning which will wake up some of our authorities in order that they may put this part of our possessions into proper order, and the sooner it is done the better.

Mr. FREDERICK YOUNG, Hon. Secretary, Royal Colonial Institute: Having been asked by the gallant reader of the paper to say a few words on this occasion, I have very great pleasure in doing so. I cannot of course approach this subject, which seems to me a professional one of great importance, from a professional point of view; but I may perhaps be permitted to make one or two remarks as a civilian. I consider it is a matter of great interest, that questions, such as I have had the pleasure from time to time of listening to in this room, on these and cognate subjects, should be discussed and ventilated here, because it enables us, the British public, to have our attention called to the fact, that we have very great interests outside the boundary of these islands, and beyond the "*silver streak*." I think it is of the highest possible importance that we should continually have our attention publicly drawn to the question, that we have great responsibilities, as well as great

and vast interests, all over the whole surface of the globe. We have had our attention drawn, in the very able paper read by the gallant General this afternoon, to a case in point. It strikes me that there are one or two important considerations to be borne in mind with regard to the best position for a harbour to protect our commerce in that hemisphere. In General Laurie's paper we have had our attention drawn, very properly as I consider, to the future. He predicts that we shall see an immense increase in our trade in the Northern Pacific as soon as the Canadian Pacific Railway is finished. We have also had our attention called to the history of the settlement of Esquimalt, which is a very remarkable one. It is an illustration of many of the things of this sort which happen in connection with the outlying parts of the British Empire. From very small beginnings, and for sometimes inadequate reasons, we fix on points of Imperial defence, as well as commercial settlements, in particular directions; and then, certain interests having been created, we keep developing them without having taken a sufficient and comprehensive grasp in the first instance, perhaps, of all which the future may afterwards bring forth. This is apparently the way in which the settlement at Esquimalt has been made. It certainly appears to me that very cogent arguments are brought forward in this paper to induce us to pause before we spend more money, which it is quite clear we must do if we continue to make Esquimalt the headquarters of our naval base of operations in that portion of the globe, in favour of transferring this base to Burrard's Inlet. No doubt the usual question stares us in the face of the cost of such transfer, but that question of costs is one of an Imperial character, ought to be incurred only in a way to produce the most valuable national results. The world, if it is not ruled by sentiment, is, at all events, very powerfully affected by it; and I am very glad to see that the gallant reader of the paper calls attention to the possible feeling which might be engendered among our fellow countrymen in Vancouver Island and Victoria if they thought that this fortified harbour and dockyard was to be transferred to the mainland and taken away from themselves. I think it is very important indeed that their feelings and sentiments should be thoroughly consulted, but at the same time I think the arguments that have been used in this paper ought to have considerable weight in reconciling them to any possible change which Imperial policy might dictate as desirable. Like my gallant friend on my left, Captain Bedford Pim, I cordially endorse the sentiments expressed in the last paragraph of this very able paper. I think the whole question is an Imperial one; and although I am aware that Captain Pim has a word in connection with politics, which I believe is not permitted in this room, I myself, while holding different political opinions to his own, hope I may be permitted to introduce a word, not of a party but of an Imperial character, and to say that I trust we shall approach all questions of this kind not from a Conservative or Liberal but from a thoroughly patriotic point of view. I will conclude by saying that I have had the greatest possible pleasure in listening to the very able and instructive paper which has been read to us this afternoon.

MR. STEPHEN WILLIAMSON, M.P.: I am scarcely fitted to take part in this discussion, being unconnected with the special branch of knowledge that has been under discussion to-day, that is to say, connected with strategical operations. But I would, nevertheless, like to express the great pleasure and interest with which I have listened to the reading of General Laurie's paper. I know something of the Pacific coast, although not of the Archipelago before us, as I have not been so far north. I entirely agree, so far as I can understand it, in the necessity of the transference of our naval base from Esquimalt to Burrard's Inlet as against all our possible enemies except one. But the intricacies of that channel, and the contiguity of our territory to that of the United States, would make it, to my mind, an extremely hazardous speculation to say that we could hold Burrard's Inlet against the immense resources of that people, should we be ever unfortunately at war with them. I do not believe, as Professor Bryce said, that we have the remotest chance of ever being at war with the United States: and, therefore, as against all other possible enemies I do believe the transference from Esquimalt to Burrard's Inlet, if it can be done without a very great outlay of public money, would be a very good thing, and at any rate it is a question well worthy of being mooted and discussed. General Laurie has spoken of the new railway coming across to Burrard's Inlet, which we hope may be opened in two or three years' time. It must not be forgotten, however, that

besides the Central Pacific Railway to San Francisco there is also to be opened very soon a Northern Pacific Railway running into Puget Sound through the northern territory of the United States, and not very far separated, almost a competing line, with this one to Burrard's Inlet through Canada. The outlet in Puget Sound (which I am very sorry the map does not show), I think, runs in from Admiralty Strait, or near thereto. The resources that could be poured through that line from the United States into the Vancouver territory would be so enormous that any expenditure in Burrard's Inlet to make it an imperial and national affair worthy of consideration, that is to say with any possible contingency of war with the United States, would be money thrown away; for I am sure we could not hold it as against the United States. But I repeat that, looking at the extremely remote contingency of our ever being at war with our brethren in the United States, and to the much more likely contingency (although I hope it may be averted) of war with some other Powers, I should say that the transference from Esquimaux, which cannot be defended, to Burrard's Inlet would be well worthy of consideration.

The Hon. Sir ALEXANDER TILLOCK GALT, G.C.M.G.: I did not propose, Mr. Chairman, to appear here in any other capacity than that of a listener to the extremely able paper which we have heard from General Laurie, but as reference has been made to two or three other points by previous speakers, perhaps you will allow me to intrude for a few minutes. First, I may say, on behalf of Canada, I feel very much indebted to the General for the extremely able paper which he has read this afternoon. He has served in Canada for many years, and it is not by any means the first service he has rendered to us, and I trust it will not be the last. I will not for a moment presume to offer any opinion upon the strategic or military reasons set forth by General Laurie, but there is one thing which I think must be evident to us, namely, that the main question of protecting the terminus of the railway is the paramount one in the defence of that coast. If you lose the command of the Pacific Railway, the supply for your defensive operations on the Pacific coast is almost entirely gone. With the possession of the railway you have communication with Canada, and very speedily with England herself. I may just say one word with regard to the possibility of having to consider war with the United States. I quite agree with Professor Bryce in saying that the matter is one beyond all probability of risk. But this may be said, that if we should by any misfortune get into a war with the United States it is not in British Columbia that the attack is going to be made. What we have really to look at in this question is the defence of the naval power of England in the Northern Pacific Ocean. In Canada we are doing our very best, and will continue to do our best, to support the efforts of England to maintain the integrity of the Empire, and I cannot respond to the jocular invitation of my friend Captain Bedford Pim in saying that we ought to serve a notice to quit. On the contrary, I believe the interests of Canada are greatly promoted by her connection with this country, and instead of a desire to assume the feeble position we should necessarily be in as an independent country, at the mercy of the United States and every other great Power, I think it is much better for us to remain part of the Empire of Great Britain. I am quite sure that the discussion which has taken place must be gratifying to General Laurie, and I am equally certain that the views which he has given will be of very great service in the settlement of this question. The railway may or may not be finished quite as early as 1885, but it is quite clear it will be finished before the defensive works which are referred to are likely to be erected; therefore, the sooner the question is pressed upon Her Majesty's Government, and also the Government of Canada, and the sooner the two Governments look into the question of the defence of their mutual interests in the North Pacific, the better it will be; we are certainly much indebted to General Laurie for being the means of bringing the subject before the Government of this country.

Admiral Sir LEOPOLD M'CLINTOCK, F.R.S.: I think we can hardly overestimate the importance of the subject which General Laurie has brought before us; we know, and Sir Alexander Galt has also told us, the extreme importance of fortifying the Canadian Railway terminus on the Pacific, by means of which war material could be brought for our forces on that shore in about fourteen days, instead of going round by sea and occupying about four months in its passage. But what

I wish to bring prominently before you is, the absolute necessity of having our *one* coal depôt in the Pacific Ocean defended. We have but this one, and on it our fleet would be dependent for supplies, and also our trading steamers, in time of war. If we lose it we must relinquish our trade in the North Pacific; and if we lose our trade in that sea we lose just so much of our daily bread. I wish to emphasize the vital importance of fortifying our coal *depôt* out there, and of having our naval position, now at Esquimalt, capable of resisting an attack. We may at times temporarily lose the command of that sea, and if such an event should happen Esquimalt would be exposed to attack. I presume it is the intention of the Government, in the event of a war, at once to withdraw from Esquimalt; and I fully agree with General Laurie in the view that he takes of the great importance of having a fortified naval station at Burrard's Inlet.

General LAURIE: Mr. Chairman, Captain Curtis has expressed the opinion that the entrance to the straits is actually the key of the position. Unquestionably it is; but then, if the vessels are to go out there (*pointing*) to hold that, they must have a strong fortified base from which to work; and it is just that very point that I am trying to establish—that if the vessels go to the mouth of the straits, assuming that we were at war with an active enemy, and it is not likely we should be at war with anybody else, there is an opportunity for a hostile vessel to lie in neutral waters. If we were at war with the United States they have the power to come out from Puget Sound forts, and attack our naval base. If we were not at war with the United States, it is most probable that they would simply be neutrals, and their ports would afford harbours in which an enemy's vessel could lie in neutral waters, and whilst our vessels were out holding the so-called key of the position, Esquimalt would be at the mercy of that vessel. It is for that reason I want to put the dockyard where it would be safe, where it can be guarded by such forces as we are likely to be able to furnish to protect it. There is no doubt that in time of war, if the United States were neutral, we should have trouble. The strongly marked line shows the boundary between the United States and the British possessions; but I believe an enemy lying within three miles of their coast would be in so-called neutral waters, and there are plenty of harbours in which a vessel could lie and shelter till an opportunity offered to strike a blow. Captain Curtis referred to the fact that coal has been discovered at Burrard's Inlet. No doubt there is coal there, as the cove near Dashing's Mills is called Coal Harbour, but with reference to the coal being brought down from Saskatchewan, that might be very valuable as a last resource, but coal that is to be brought 600 or 800 miles would be very expensive by the time it reached the terminus, and as long as you can get coal at Nanaimo, three miles from a shipping point, it is much more advantageous than having to go over the Rocky Mountains for it, but of course it is a capital thing for Canada that we have that coal up there in those plains where wood is scarce.

Captain CURTIS: I spoke of coal with reference to the railway.

General LAURIE: I was speaking more with reference to the ship supply. With reference to Mr. Pfoundes' remark as to China and Japan, I would only say I do not desire that we should fight with any particular nation; I hope we may remain at peace with all the world, but at the same time the inference from our keeping up an army and navy is that we do expect at some time to have to use it; therefore we naturally look round and see who our probable and possible enemies may be—those who are likely to be brought into contact with us, whose interests are likely to come foul of our own, and therefore who we are likely to quarrel with. I hope we shall have no fight there, but I cannot help thinking that the Pacific will more than probably be the scene of the next great naval contest. That has been my opinion for years past, and hence my anxiety to bring this question into notice. With regard to the relative power of England in the Pacific, it is all very well to say that we have the command of the sea, but though we may have the largest number of vessels afloat, it does not follow that we have a superior number in the particular place where they are wanted, and our position was not so satisfactory a few years ago when we had to take a wooden frigate and try and make a Peruvian ironclad behave itself. I do not think that Admiral de Horsey would care to repeat that experiment more than he could help. Not only that, but the photographs I have seen hanging up in the various houses in Victoria of the "Shah" with her bows out of the water in order

that the shot holes might be filled up, did not give one the idea that we had the command of the sea and had it all our own way. With the enormous interests we have to protect, it seems almost impossible for us to maintain ironclads sufficient to deal with opponents wherever trouble may arise, and I must say the reference Captain Bedford Pim has made to the fact of a squadron of eleven Russian vessels lying in San Francisco at one time shows that numerically we had not a preponderance of power in the place where it might have been very important to us that we should have it.

Captain BEDFORD PIM: Over all the Pacific at that time we had seven ships.

General LAURIE: And some of them are perhaps not as first class as we should like!

Captain BEDFORD PIM: They averaged seven knots—the whole of them.

General LAURIE: With regard to the suggestion that we should send out some of our old ironclads to protect the Esquimalt Harbour, if they are not fit to keep the sea I do not know how they would get round Cape Horn.

Captain BEDFORD PIM: They would be nursed round.

General LAURIE: The enormous increase of commerce that may be expected when the railway is finished gives, to my mind, an additional reason why we should strengthen our squadron on that station. With regard to the cost of moving the yard to Burrard's Inlet, I fancy anybody looking at that yard would see that the expense attending its erection was not very great. Really the cost of the buildings is almost nominal, they are simply wooden sheds. Mr. Williamson thinks we could not hold Burrard's Inlet against the United States. Of course that raises the larger question which Sir Alexander Galt has put in another shape, whether we could hold Canada at all against the United States. Some of us think we could; at any rate, Canada has made up its mind to try, and the people most interested in the matter, the Canadians, have determined to throw in their lot with England: and if such an unfortunate occurrence as a war with the States should happen, the Canadians intend to keep the old Union Jack flying, and to protect it as long as they can. And I fancy what applies to other parts of British North America will apply to British Columbia, small as the population there is. It is quite certain the important fight would not be in British Columbia, but at the same time there would naturally be an effort made to destroy our naval stores there, and it seems desirable, to my mind, that they should be placed in the most defensive position, where they could best be protected, and if they can be placed where they can only be attacked on one side on a very small front, where they cannot be approached by the rear. We are reminded, on a somewhat larger scale, of Leonidas and his 300 Spartans, how they held the narrow-fronted pass of Thermopylæ against untold Persians. You must recollect the thing is to hold out while the ships are absent, to hold it temporarily, not permanently; and I believe that could be done if the garrison had the proposed advantages of defence. It is not settled yet where the Northern Pacific Railway is to strike Puget Sound. The fact of that Northern Pacific coming in behind Esquimalt, as it were, higher up the Sound, so that any expedition prepared at the terminus of the Northern Pacific would pass to the upper side of San Juan Island, and would pass direct to Nanaimo without being exposed to an attack from Esquimalt in passing, puts us at present in the false position that, even although we have the command of the sea, we still might have our coal depôt at Nanaimo burnt. That is why I am anxious we should establish ourselves at Burrard's Inlet, and there we should be able to attack any expedition in flank. Of course the coal is everything, as Sir Leopold M'Clintock pointed out. Sir Edward Selby Smyth, who formerly commanded the Militia in Canada and who visited this province, strongly recommended that a nucleus of regular troops, in the shape of a small body of marines, should be maintained at the naval station wherever it may be; but a small body of marines at Esquimalt would be simply placed there to be gobbled up by the first cruiser that came along. But placed at Burrard's Inlet they have a much better chance of holding their own. Captain Colomb has so lately lectured in this theatre on the subject of the employment of marines and the wonderful way in which their organization fits them for this very work—detached Colonial employ—that it almost seems as if the two subjects fitted in together. I am sorry he was unable to come here to-day, because he brought up that subject, mainly with the view of showing

their capacity for Colonial defence. I must thank all present for kindly attending to-day to hear this, my maiden effort in the shape of a paper on a technical subject, and for the kind way in which you have encouraged me to believe that my remarks have not been altogether thrown away.

The CHAIRMAN: It only remains for me now to offer, in your name, our very best thanks to the lecturer for the extremely able paper he has read to us this afternoon. He has called our attention to the fact that our naval establishments abroad require to be efficiently and adequately protected, and that in the North Pacific our naval station is no exception to that general rule. And I venture to think, though I speak with diffidence on the question, that he has shown very good and sound reason for the position that he has recommended for our naval establishment. Of course these matters are always open to consideration from various points of view, but I sincerely hope that this lecture will meet with its merited consideration from those who are responsible for the defence of the country.

Friday, April 13, 1883.

VICE-ADMIRAL W. G. LUARD, C.B., President, Royal Naval College,
Greenwich, in the Chair.

ON COALING SHIPS OR SQUADRONS ON THE OPEN SEA.

By Lieut. R. S. LOWRY, R.N.

Read by Lieut.-General LOWRY, C.B.

The CHAIRMAN: The author of this paper is serving on the Australian Station, in the "Espiègle," and his father, General Lowry, will read it to us.

General LOWRY: I must ask the kind indulgence of my comrades of the sister Service if, in putting before them the contents of my son's paper, I prove that I am myself somewhat "at sea" on the subject. That subject is important, and I trust its treatment and discussion to-day may be productive of some good to the public service.

SOME apology is due from one like myself, without much practical experience in it, for writing on the above subject. It is solely in the hope that far abler hands than mine may be induced to take it up that I venture to touch it. Nevertheless, its vast importance, and the need for its full consideration in every detail before the outbreak of a naval war, has been strongly impressed upon me both by the careful study of able articles from British and foreign pens, and from a recent personal experience of the difficulties to be met when coaling where proper appliances for doing so are not to be found.

Few will deny that the mobility of our ships and squadrons, their usefulness, and to use a slang, but very expressive term, their "staying powers," would be vastly increased if some effective plan were found for coaling at sea.

I think I am within the mark in stating that during the blockade of Charleston by the Federal fleet, nearly one quarter of that force were always absent from before the port, employed in filling their coal-bunkers.

During the same war Federal cruizers while searching for the "Alabama" were constantly obliged to quit that portion of the ocean allotted to them, in order to fill their bunkers after one or two useless chases of suspicious-looking vessels. But those who have read the various able papers on the different branches of Naval War published in the Journal of this Institution, cannot fail to have been struck with the necessity which must so often arise of replenishing coal-bunkers at times when it would be most detrimental to the service on which the ship may be employed, had she to proceed to the nearest friendly port for that purpose.

To quote a few writers in support of this opinion—

Captain J. C. R. Colomb, R.M.A., in his able paper on "Naval Intelligence and Protection of Commerce in War," states that—

"We have in maritime war to provide for three great naval operations:

"1st. Blockade of the enemy's coast.

"2nd. Securing the ocean routes of the world.

"3rd. Coast covering operations off neutral seaboard to provide safety for our commerce between such seaboard and the ocean routes."

Dealing with (1) on Blockades—

Captain S. Long, R.N., in his paper on "Naval Blockades as affected by Modern Weapons" (which unfortunately I have not by me at this moment, and so am unable to quote *verbatim*), lays it down as "absolutely essential to the maintenance of an efficient blockade that the blockading fleet should be within easy reach of their base, or at least seize some island near at hand from which coaling could be easily carried out."

Provisioning is, of course, equally essential, but all ships can carry provisions for three or four months, few could stow coal for as many weeks, especially if false alarms or chases cause full steam-power to be used occasionally. Could the fleet be kept supplied with coal by steam colliers and this transhipped while lying off the port, the numbers of ships in it might be reduced, the coal would last longer (that consumed on passage to and from the base of operations being saved), and the arrangement of reliefs would be greatly simplified.

Of course the advantage of such an arrangement would be more felt in the blockade of ports distant from our base, such as Toulon, Rochefort, Cronstadt, or New York, than in ones close to a coaling station of our own, such as Cherbourg, Jahde, or Portland (U.S.A.).

(2) and (3) may be dealt with together, for cruisers employed off neutral seaboard would be unable to obtain their coal from neutral ports, and would depend on British colliers for their supply, hence they would come under the same category as the cruisers employed on the great ocean routes.

Captain Colomb, in the before-mentioned paper, has told us how, by the proper working of a Naval Intelligence Department, the Captain of a cruiser (whether our own, or the enemy's) might know where to lie in wait for any number of British colliers carrying coal to neutral ports.

As yet we have had no practical solution of the difficulty of transshipping this coal in average Atlantic weather on the open sea.

Sir T. Brassey, K.C.B., in his work on "The British Navy," says: "The limited supply of coal is a most serious defect in English vessels of the older types." He gives the coal endurance of the "Inconstant" at $2\frac{1}{4}$ days, and of the "Shah" at 4 days full speed steaming. Of what use would either of these ships be after steaming easily into the centre of the North Atlantic, perhaps having had steam ready for full speed at daylight on 10 successive mornings, if called on to carry out a protracted chase?

Captain Scott, R.N., in the discussion on Sir T. Brassey's paper on "Unarmoured Ships," read at the Institution of Naval Architects, Session of 1876, states: "I think, moreover, that you require, if you have groups of squadrons, somewhat equal coal-carrying power, or *means of coaling at sea which we have not yet hit upon.*"

Had I the back numbers of the Journal by me, I believe many other and similar opinions might be quoted from its papers and discussions, all tending to show the importance of this subject, and the small amount of consideration which it has as yet, apparently, received.

Those who served in the Channel Squadron in August, 1870, will well remember the delay of that squadron for nearly a day between Lisbon and Vigo, the hard work, the damage done to boats, the great part of a day occupied, and the risks incurred whilst endeavouring to supply Her Majesty's Ship "Captain" with some 50 tons of coal from the bunkers of two other ships. I have neither logs nor journals by me now, but if memory serves me right, in fine weather, and the boats of a large fleet available, only 30 tons were transhipped in about six hours (enough for two days' moderate steaming), *and this coal was mostly wet*, through being carried in open boats unprotected from spray. To avoid risk of foundering the boats had to carry but light loads; the time occupied being of course lengthened by the fact that steam launches were at that time less common, and less easy to hoist out in a sea-way than now, so that most boats were worked under oars. When lying alongside, of course the greatest care had to be taken in sending boats off, and during the six hours many narrow escapes from serious injury or total loss were run by the boats. Of course it is much more difficult to tranship coal from the *bunkers* of one ship to those of another, than it would be to do so from the *hold* of a collier, but as labour power was practically unlimited in the ship's filling bags, this did not materially retard the rate of transshipment, which appeared to be affected solely by the difficulties of water-transport.

In the most perfectly calm weather most serious risk of injury to the lighter fittings on a ship's side would be run by attempting to allow the collier to lie alongside, and on 99 days out of 100 in the North Atlantic, this would be impossible. In most ships ample numbers of hands are available for the work of filling, emptying, transshipping, and hoisting coal, the great difficulty is how to get it over the intervening water space between collier and ship, with safety and rapidity, keeping the coal dry. It would also be a convenience if the coaling could be carried out without entirely stopping the ships, say, under easy steam of 4 or 5 knots.

At present the only available appliances seem to be the boats of the ship and of the collier, the coal itself being carried in bags.

Unless supplemented by an extra supply in the collier, the complement of coal-bags allowed to men-of-war, which is about 5 per 100 of indicated horse-power, would rarely be sufficient to allow coaling to be carried out in ordinary ships' boats without delay from this cause. Recently when coaling the sloop in which I am now serving

in one of the South Pacific Islands, only the cutter and steam cutter (without engine and boiler) were used in bringing the coal off from the shore; the establishment of coal-bags (71) was insufficient to load both boats, and the time occupied in coaling was nearly doubled from this reason, the working parties both afloat and on shore being frequently obliged to wait for each other. Ordinary ships' boats and bags utterly fail to keep the coal dry in any loup of the sea or rain.

This plan, too, is quite impracticable in a fresh breeze, and even in moderate weather entails much risk of foundering on the boats employed; the stoppage of the fleet or ship is also necessary.

Any satisfactory means of coaling at sea ought apparently to satisfy the following conditions:—

(1.) *Rapidity*.—Nothing short of 20 tons per hour for an ironclad if hoisting overall, or 40 tons if she has several ports that can be worked for coaling, or 15 tons in a small vessel, ought to be considered a satisfactory solution.

(2.) *Safety*.—The coaling must be capable of being carried out in any breeze in which ships' boats not heavily laden could carry working parties to and fro with facility. The boats or coal-carriers employed must be safe from sinking even if accidentally filled or injured in transit.

If any form of pneumatic or other tube is used as a coal-shoot between the ships, it must allow of the ships being at least 20 yards apart if steaming through the water, or 100 yards if both are stopped. It must also be very flexible to allow for the motion of the ships.

(3.) *The coal must be kept dry* to avoid danger from spontaneous combustion, and deterioration while in the bunkers.

(4.) *The coal-carriers or boats ought to be such that they can be towed alongside the ship from the collier while both are going at a speed of 5 knots*.—Owing to the particular service on which they are ordered, it may be most important not to stop the ship or fleet entirely. With a large squadron, the capacity of whose bunkers may vary greatly, one ship may require coaling much before another, and it may be inconvenient to stop the squadron, or risky to leave one ship behind, let us say in the supposed vicinity of an enemy's fleet.

(5.) If boats are used, they must be such as can be conveniently hoisted at the collier's davits; if some other form of coal-carrier, they must be such as can be conveniently stowed in the collier's hold or on her decks.

(6.) The minimum of labour should be required for filling, hoisting, or emptying them; they must therefore be of minimum size and weight for the amount of coal they carry.

(7.) Without being too expensive, they must be of strength and durability enough to stand considerable knocking about at sea and on foreign stations.

On studying the above conditions, it appears to me that they cannot be satisfactorily fulfilled by any ordinary boat carriage, but that they could be by means of some form of water-tight coal-carriers, and possibly by a pneumatic tube connecting the vessels. This latter proposal I do not feel myself competent to work out in detail.

In both, the practical working and the amount of coal carried, would be immensely facilitated and increased if, for ocean-coaling, some form of patent fuel were used.

Taking the conditions *seriatim*, let us see what qualifications the "coal-carrier" must have to fulfil them.

(1.) *Rapidity.*

(a.) The "carrier" must be of such a type that it can be filled, closed, opened, and emptied at least as fast as an ordinary coal-bag, *i.e.*, 10 men in a commodious hold ought to be able to fill 8 tons in an hour.

If the carrier is formed of some hard substance, as iron or wood, it will not require one man to keep the mouth open as in filling canvas bags, hence a gain of nearly 30 per cent. in labour when filling. The top should close easily and make a water-tight joint, the carrier either turning over or the bottom opening mechanically in one motion. The carrier must be of such a height and shape as to be readily filled by means of shovels, and not be more than 3 feet high. The coals should fall out on the deck by their own weight.

(b.) It must be of such a form as to be easily towed, therefore not too bluff at the ends, and the slings and towing spans so formed that a long series of carriers or a continuous stream could be kept going between the collier and the ship.

(c.) It must be of such weight as to be easily hoisted inboard by the yards, coaling ports, or derricks; for this purpose $1\frac{1}{2}$ tons might be taken as the limit of weight for each filled carrier if to be hoisted at the yard-arm, or a $\frac{1}{4}$ ton for very small ships or coaling ports.

(d.) The slings must be so made as to be readily hooked on in a tumbling sea with the ship moving 5 knots; for this purpose the upper ring of slings must be fitted to stand up rigidly, and be about 1 foot in diameter, so that a large hook could be readily guided into it. This hook must be such that it will not come accidentally unhooked if the carrier be suddenly lifted by the sea; some form of spring like that fitted to a watch-guard hook would answer this purpose.

(e.) The towing arrangements must be such as can be readily slipped without the necessity of a man going into the water, or on to the carrier for that purpose.

(f.) The carrier must be easily closed, hoisted out empty, and returned to the collier for refilling.

(2.) *Safety.*

(a.) The carrier must be water-tight and carry a sufficient quantity of air in a compartment separate from the coal to ensure its flotation, even if the coal gets flooded.

(b.) Strength sufficient to protect from injury in case of striking bolts, &c., in the ship's sides.

(c.) Slings, both towing and hoisting, of ample strength.

(3.) *Coal to be kept dry.*—This entails water-tight joints for all openings in the “carrier.”

Nos. 4, 5, 6, and 7 must be dealt with when considering the forms of coal-carriers suggested, but convenience of stowage renders it necessary that the rigid ring for hoisting should fit into some form of countersunk hole for stowing away, and that the angles of the carriers are such as to fit into each other when several are stowed together, in such a manner as to avoid having empty spaces left between the carriers.

It would greatly expedite the coaling of small ships, and to a less extent of larger vessels also, if the first 100 tons at least could be stowed in the carriers before the collier leaves port. I am aware that by doing so some space will be lost and considerable expense incurred, but during *war time* it is often of invaluable importance, and by wasting it an opportunity may be lost which perhaps will never recur. A vessel in the act of coaling, her decks lumbered, and with perhaps many of her men in the collier, must be looked on as almost useless for the time: if an enemy be then sighted, some delay must occur before chase could be given. Again, all coal must be stowed, and the ship ready to clear for action before nightfall, or a heavy squall or fog may come rapidly on, in which it would be most dangerous to be towing hawsers, carriers, or boats: hence, even a few hours' or minutes' delay in coaling at sea is a thing to be avoided; it ought to be made an evolution, well thought out and systematically arranged for beforehand.

If it were possible I would stow coal with as much care as provisions, every hundred-weight in its own case. That this is not an impracticable suggestion may be inferred from the fact that all the coal sent out from England to a mercantile firm in Brass River on the West Coast of Africa a few years ago (and for all I know still is) came in 5 cwt. wooden casks perfectly water-tight. Her Majesty's ship “Pioneer” when coaling used to tow these alongside, and hoist them inboard. In this case the casks of coal were not intended for use aboard ship, or in any very large quantities, and some delay was occasioned by the want of properly fitted towing and hoisting slings, and by the time taken in starting the hoops and wooden head.

All this would be obviated in carriers specially made for the purpose.

The best form of these carriers and the details of their construction would probably be more effectively dealt with by a mechanical engineer than by a naval Officer. As in the question of ship construction, I imagine that it is far better for us to state definitely what we require, and leave those who have made such subjects their life-long study to meet our requirements as nearly as they can. Nevertheless, I think it is well to give a rough sketch of a coal-carrier which will meet *some* of the requirements, leaving it to cleverer heads to work out, develop, and mature the idea.

While considering the coal-carrier, I have suggested but a very inferior one, and hoping that it may lead to the proposal of a far better one, let us see how it will meet the requirements laid down.

(1.) *Rapidity.*

(a.) The carrier can be filled quickly, as it stands only 3 feet high, the door is large enough for three men to work together at, and the coal falls by its own weight into any part of the box.

It can be closed quickly by half a dozen turns of three screws, which make the joint water-tight.

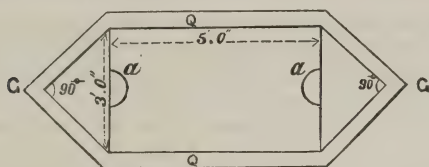
To empty it, the catch slips which hold these screws can be knocked off with a hammer, the side opening outwards from the hinge below the air-box, and nearly all the coal falling out by its own weight, the remaining small quantity being easily tilted out.

(b.) Facility of towage.

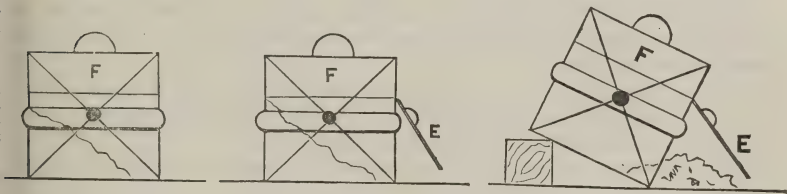
CARRIER. PLAN.

Largest size to carry one ton.

Weight of case $1\frac{3}{8}$ tons when filled and ready for hoisting out.

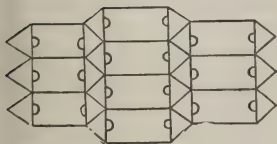


Semicircular or half rings at *a*, and lying flat in countersunk holes for stowage.

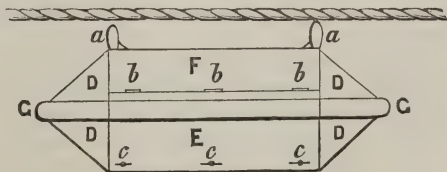


F. Air chamber. E. Door.

Towing hawser.



Method of stowage in hold of collier.



Side view.

a. Half rings standing up and keyed there.

b. Hinges to door.

c. Fastenings to door.

D. Coals.

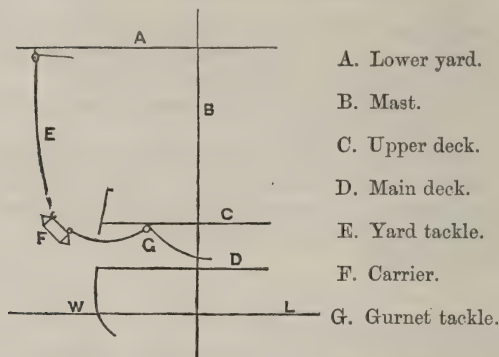
E. Door.

F. Air chamber, 15 cubic feet.

G. Cork pudding, 2 inches in thickness.

2 D

Method of hoisting through coaling ports.



- A. Lower yard.
- B. Mast.
- C. Upper deck.
- D. Main deck.
- E. Yard tackle.
- F. Carrier.
- G. Gurnet tackle.

The pyramidal ends ought to oppose but a small resistance to the water. If specially prepared strops and toggles (with laniards) are used on the towing hawser, any number of carriers could be fast to the same hawser at very small intervals apart.

(c.) The sketch and dimensions given are for the largest sized carrier proposed with a weight of $1\frac{3}{8}$ tons when full. Probably one of half the above dimensions, carrying half a ton of coal and weighing $\frac{3}{4}$ of a ton when full, would prove most convenient for ordinary service.

(d.) Ease in hooking on the hoisting tackle to the slings seems ensured by the semicircular ring one foot in diameter, and, when keyed, standing rigidly up.

(e.) Special strops on the towing hawser, with well greased toggles and loops attached, ought to be easily slipped with a boat hook, or by hand when the carrier is lifted out of the water.

(f.) The empty carrier can be hoisted out at least as quickly as the full one.

(2.) *Safety.*

(a.) The air-box proposed is sufficient to support the weight of carrier and coal if made of the size proposed, even if the coal gets flooded.

(b.) Strength. If made of $\frac{1}{8}$ in. steel, or $\frac{3}{16}$ in. iron, and protected by a cork "fender" or "puddings" round the centre and angles, it ought to stand all ordinary rough usage.

(c.) The rings for slings can be made of any desired thickness.

(3.) The coal ought to be easily kept dry, for there is only one opening to the case, and that is flat and oblong, long but narrow, so that it could be easily rendered perfectly water-tight when screwed well home to an india-rubber seating.

(4.) As the carriers are water-tight and sharp ended, they can be towed alongside the ship at any moderate speed.

(5.) The ends of the carriers forming a right angle, they can be stowed close against each other as shown in "plan of stowage."

(6.) This depends mainly on material used and workmanship in construction.

(7.) The carrier proposed does not seem to be very expensive, as it can be kept in store or in use for years, and is available for any class of ship.

In conclusion, I must warmly disclaim any idea of having solved this question, but I do hope that, having brought its claims and its importance forward, those who have time and talent will not rest until it can no longer be said that "we have not yet hit upon a means of coaling at sea." It may be long ere some apparently perfect plan is proposed, but in the meantime any fairly good one is better than none.

Let us follow the old "Excellent's" motto, "Si vis pacem para bellum," and in coaling as in the greater and more attractive subject of gunnery, let our motto be, "Ready, aye Ready."

General LOWRY: I sent a copy of this paper to Captain J. C. R. Colomb, R.M.A., for any remarks he might desire to make on this occasion. That gallant Officer is so well known to members of the United Service Institution as one of large views and well thought out and matured opinions on most subjects coming under his consideration, that I venture to ask the Chairman's and your permission to supplement the paper you have heard, and open its discussion by reading Captain Colomb's remarks on it:—

"Having through the kindness of General Lowry had the advantage and pleasure of reading the valuable paper by his son, Lieutenant Lowry, R.N., 'On Coaling Ships or Squadrons on the Open Sea,' I wish to express my very great regret at being prevented from attending the lecture in person, and taking part in a discussion which I hope may be worthy of the very important question with which the lecture deals. I should wish to take this opportunity of congratulating the Naval Service on the fact that this paper gives evidence that young naval Officers, as represented on this occasion by Lieutenant Lowry's paper, appear to grasp boldly problems which maritime war will certainly present for England's solution, and it is therefore gratifying to note them treading worthily the path of their distinguished seniors in the Service. It is, I think, hardly correct for the writer of the excellent paper to state 'that cruisers employed off neutral seaboard would be *unable* to obtain their coal from neutral ports' in war; I think both international law and custom, established by precedent, will entitle the war-ships of a belligerent to obtain from a neutral, without any infringement of neutrality, sufficient coal to enable the war-ship to proceed to the nearest port belonging to her flag. There are limitations as to time, &c., which I need not now allude to. But his fact really enforces the importance of the question raised in this paper. Because, as I have elsewhere often pointed out, this international law or custom must be in the nature of the case operate to the disadvantage of England when engaged in maritime war, because England has ports on every sea and in every quarter of the world. For example, suppose a war with Russia. Say in the Pacific a Russian war-ship, followed by a British war-vessel, comes from the southward—both with exhausted coal bunkers—to San Francisco. The quantity of coal allowed to the Russian war-ship would be calculated by the quantity of coal she would require to cross the ocean to her nearest port, Vladivostok, while the British supply would be measured only by the quantity necessary to take her, as it were, round the corner, to Esquimaux. Now, with bunkers full, the Russian war-ship may go south to prey on our commerce; the British war-ship *must* go north if she is once more to become efficient by having her bunkers filled. I take this example as not merely a possible, but, I think, a very certain description of what will very likely happen during maritime war, and I select the Pacific because it is the ocean on which the author of the paper is serving. Next to the defence of our fixed coaling stations, comes, I think, the question (excellently and most modestly) raised by Lieutenant Lowry, and there-

fore, in the interests of the protection in war of our huge mercantile marine, I trust the paper will attract the serious attention it deserves. In the example I have given, our risks and dangers could only be obviated by coaling the British ships at sea beyond the neutrality limits of San Francisco. I can see grave mechanical difficulties must be overcome, but I entirely agree with the writer, 'that it is far better for naval Officers to state definitely what they require,' and I feel sure that if it be possible for mechanical contrivance to overcome the difficulties presented by the requirements of the Naval Service, those difficulties can and will be overcome by that pre-eminent engineering skill which England possesses."

The CHAIRMAN: It is now my duty to call upon any of those gentlemen who wish to take part in this discussion.

Admiral SELWYN: I recognize with great pleasure the very clever and well thought out attempt at the solution of a great problem which has been put before us. Unfortunately, there is no doubt whatever that the necessities of the case have confined us down to a most unsatisfactory quantity of fuel on board steamers at sea. It is all very well to say that you can go at low speed for a long time; but that depends on what your adversary thinks about the matter, and it will never be satisfactory to my mind until what I think I see in the near future takes place, when thirty days' fuel can be carried at sea for full steam power; but that we have not got yet. I think it will not be a year before you do get it. But the problem of how to coal at sea is one to which I, too, have paid some attention. I am not going to bring forward my own ideas against Lieutenant Lowry's, but simply to examine what are the difficulties which must stand in his way. He has, in my opinion, thought out the matter as closely as any man could possibly do, nor do I recognize anything about the whole plan which might not be accepted or fathered with pride by any engineer in the kingdom. He has considered the space, the expense, the mode of action, in a way that very many engineers could not have considered it, not having the experience at sea which is necessary to do so. But there is still the difficulty that, to do this, you must stop your fleet, or bring them down to a very low speed, which is undesirable. I think it can be done without interfering with the speed of the ship at all. Then he has got a great number of rather expensive coal cases to be carried in colliers, which, as he says, add considerably to the expense and to the space requisite where he introduces air-chambers, as he necessarily and very wisely does, and this comes out simply as a matter of money. It costs so much more money per ton of coal put on board the ship. Now, to some persons that would be a very serious objection; but to my mind, there is no price of fuel whatever that can be thought of for one instant in comparison with the efficiency of our fleet. If that be fully secured, then neither the nation nor the Government ought to find fault with the expense at which it is done. But as our preparations in the Navy must be continuous and permanent, it seems that you would have invariably to carry these cases when they were not required. Now that I regard as rather a more serious difficulty. They must be on the spot. You may get coals, for instance, from several of our Colonies. Can you expect these chambers to be always supplied to the colliers at the coal mines? I think there is something to be thought out there, as to how it would work, which must lead people to consider afresh the whole subject, and to weigh that difficulty in comparison with other difficulties belonging to any other system. But after all, gentlemen, good as this plan is, excellent as I believe it would be in practice, as Lieutenant Lowry proposes, prevention is very much better than cure. Let us turn all our attention, as it has not been turned, I am sorry to say, to those means which may enable us, first, to economize our fuel. For the last fifteen years there has been steadily put forward a thing which is now succeeding admirably well in private hands, in which only 1 lb. of coal per indicated horsepower is required instead of $2\frac{1}{2}$ lbs. That is the first thing to be considered, before you consider what you will do with the coal after you have got it in your collier. The reason why I ceased to turn my attention so strongly in this direction as I had done previously, was that I am absolutely confident you are going to see the end of coal for steam fuel at sea altogether. It will not pay to take coal on board ship at this moment. We have not done much in the matter since I first attacked the subject some years ago, but the Russians, I am happy to say, are finding out the

value of liquid fuel, and when you get liquid fuel, I need not tell you, all these difficulties of passing it from one ship to another will very materially disappear. I have said everything I can in praise of Lieutenant Lowry's plan; I think it very good indeed for our present necessities, but I trust to see those necessities largely abolished in the future. I am quite sure that if half the attention were given to this subject which has been given to the guns, which are utterly useless without the power to carry them about, we should long ago have seen a solution, and a satisfactory one. I believe that it is the practice to refer these matters to Committees. Now on that subject, I heard a very clever dictum, coming from a curious kind of authority, which I may repeat. Mr. Moody, of Moody and Sankey, appears to have been plagued, I do not know whether in his musical or religious work, by Committees, and he at last brought out a piece of concrete wisdom, which I commend to the serious attention of every Englishman: "If Noah had had a Committee, the Ark would never have been built."

Captain BEDFORD PIM, R.N.: The gallant General commenced by saying that he was somewhat at sea in reading this paper. I am sure you will agree with me that, had the son been present, he could not have done more justice to the paper than his father has done. It is seldom one hears a paper more admirably read. I think I should be disposed to attack this subject from a different standpoint altogether from that which Lieutenant Lowry takes. I do not quite understand how he could transport this coal from one ship to another, especially in these days of long ships, when the collier would be rolling, gunwale under, on the slightest possible provocation. But I think I should attack it in this way. Sir E. J. Reed told us, many years ago, that an ironclad could be built to sail as well as steam, equal at all events to the fine old wooden frigates, &c., of the past. Now, we know that no ironclad is worth much at sea under sail. Why do we not build ships that will keep the sea under sail, the same as the ships of our forefathers did, as long as the provisions lasted? There is no difficulty about it. It seems to me the coal question would then be solved. If you had ships, from gunboats up to ironclads, that could keep the sea under sail as long as their provisions lasted, you might save your coal, and only use it to draw off a lee-shore or engage an enemy. Then you would have no necessity to coal a ship on the ocean, which I, as an old-fashioned seaman, am afraid is altogether impracticable with even a light sea on. I do not see how you are going to coal a ship in mid-ocean. You may transfer a small quantity on an emergency, but nothing more. With regard to international law, all the coal you are allowed from a neutral port in time of war—for coal is a contraband of war—is just enough to take you to your next home port. Well, as Captain Colomb has pointed out so well in the letter which he has written to General Lowry, on the Pacific coast it would be a very serious matter indeed. We could only take coal on board sufficient to take us, say, from San Francisco to Esquimalt, 600 miles, while the Russians would be entitled to sufficient to take them to Vladivostok, several thousands of miles from San Francisco. I do not mean to say that the Russian men-of-war would avoid going to Vladivostok; but, supposing they did, and turned back and fell on some of our so-called cruisers, it would not be pleasant, but rather a serious matter. But I think this difficulty with regard to the Pacific might be solved in this way. There are some islands, which I was employed in surveying some years ago, the Galapagos. They would make a splendid coal-dépôt. Why do not the Government, for a few thousand pounds, buy the Galapagos, where you might have anchorage in the smoothest of water and render the coal dépôt impregnable, and take your ships in any time you please? No more central place could be found on the Pacific station, and nothing would be easier than to turn them into a large coal centre. I am afraid that if you rely upon Esquimalt in the event of war, you will rely upon that which will fail you. I hope that some of the younger Officers will take up the thread of the argument and give us the opinions they entertain of coaling an ironclad on the open sea.

Captain NOEL, R.N.: I have only a few remarks to make on the paper. I think Lieutenant Lowry deserves very great credit for bringing this subject before the Institution. I am very much impressed with the manner in which his plans have been worked out, and I think them deserving of a great deal of credit as a bit of engineering. There is no doubt that this subject is one of the very

greatest importance; our ships of war must be limited in their coal capacity, and therefore we shall suffer if we cannot get coals under certain circumstances. Economy of coal is the question of the day, or it will be, when we go to war; and if we can economize coal by any other means, such as by use of sail power, so much the better. I am going to read a paper here shortly on the sail power of ships of war. I consider it essential for all cruising vessels that they should have some other means of propulsion besides steam; still such other means of propulsion is only to assist in economizing fuel. Here we have a means of facilitating the supply of fuel. Of course we must be continually coaling, and I quite think we ought to find out a way of coaling at sea for several reasons. In the first place, in a severe war we may find that the coaling stations that we reckoned so much upon have been seized by the enemy, perhaps are held, or the coal destroyed: so we must have colliers with us. In order to keep our ships free to work under steam they must have colliers with them. In calm weather coaling at sea is not attended with any very great difficulty; but then we cannot always wait for calm weather, and then it comes to the question of how we are to coal, and I must say Lieutenant Lowry has done very great service in moving this question. I do not quite like his plan. I do not think the coaling can be done with any great speed in closed carriers, but there might be times when you could not coal in any other way. Therefore I think that if a steamer is sent out with coal to attend on the squadron or vessel, whichever it is, it would be very well if she had a hundred or so of these carriers, or carriers of a similar nature. I should not trust entirely to them: they would only be requisite under very exceptional circumstances. In my opinion a steam collier should carry actual coaling barges, say of 50 tons: let every collier that goes out with the fleet carry four large iron barges properly fitted with fenders, then there would be no more difficulty in coaling at sea in moderate weather than there is in coaling in an open roadstead which we have all experienced, and, as far as passing through the water is concerned, in the Mersey it is seldom you have a tide of less than 5 knots, which is exactly the same thing as passing through the water at that speed when under weigh. I think it would be a good thing if the colliers which are sent out to the fleet were provided with various appliances—among them some means of carrying coal, such as that proposed by Lieutenant Lowry. Of course it is necessary to coal at great speed, where you can, and the system of coaling at speed, no doubt, rests in a great measure on having the coal in bags. There might be some question about the stowage of coal in bags on board ship, whether the material would be liable to cause spontaneous combustion or something of that sort; but if the tar in the present bags is a source of danger, we must find bags which are not so dangerous. Coal, I consider, should be carried in bags; the colliers should be supplied with coal-lighters and perhaps, in addition, some of these carriers. I think the Institution has every reason to thank Lieutenant Lowry for bringing this subject before them.

The CHAIRMAN: Failing anyone else making a few remarks, perhaps you will allow me to do so. I have been unexpectedly asked to take the chair here to-day, having intended to be present at an interesting lecture now going on at Woolwich on a question in which we all are interested—the bombardment of the forts of Alexandria—but there was a failure of a Chairman, and I am only too glad to supply his place. I am not prepared to enter into any particular remarks on the question beyond those which suggested themselves as the paper was being read. I think we cannot express ourselves too strongly upon the matter of an Officer like Lieutenant Lowry bringing such a paper to the notice of the Institution. It is extremely valuable that we should have the ideas of the younger Officers in the Service, because they are the people who have to encounter and overcome such practical difficulties as exist in coaling ships at all times, and especially at sea. Now the question of coaling ships at sea is no doubt an extremely important one, and yet one which I believe has hitherto received little or no attention. I regret that we have not some one from the Admiralty here to-day that we might hear what their opinions on the subject are. Lieutenant Lowry commences by expressing his idea of the great importance of the subject, that it should be fully considered before the outbreak of a naval war, and there is no doubt the only people who can really take that subject into satisfactory consideration are the Admiralty themselves. Probably

they may be induced by what passes here to-day to give at all events some passing consideration to it. The point which Lieutenant Lowry dwells on next, and which I think seems to be of the greatest importance, is that it is not the difficulty of filling the coals on board the collier or of hoisting them in on board a man-of-war, but the difficulty of how to get over the intervening water space between the collier and the ship. I am sorry to say that I cannot for one moment believe in the practicability of this plan which has been put before us to-day. Its great merit is, I think, in directing attention to the necessity for some means of getting over that intervening space between the collier and the ship wanting the coals. There is no doubt that there must be colliers accompanying our squadrons in the future, and the question is, how to get over the intervening space of water between them and the ships. Take the type of vessel which we all know now, the "Hecla" type, which has been so successfully fitted as a torpedo-ship, and imagine her used as a collier. I believe that will be something of the type of ship that will be employed as a collier in the future. We have now the means of hoisting up very heavy torpedo-boats. That is a necessity which was forced upon us, and as soon as it was forced upon us it was successfully overcome. There are some davits now made which, with perfect safety, will hoist up all but the first-class torpedo-boats. I think Captain Noel has hit exactly upon the right means of overcoming the difficulty of getting over the intervening space. Coaling must always be done, I believe, by bags, and not by vessels constructed of hard, rigid, uneven surfaces, and there would be no difficulty in making bags incombustible, not liable to spontaneous combustion, and with these davits I have mentioned, there would be no difficulty in hoisting up suitable boats (I will not call them barges) for conveying the coal from the collier to the man-of-war. Those boats I imagine would be devised to carry from 20 to 25 tons, and with a turtle-back deck over them, leaving only a space in the centre, also protected by a high combing, through which the coals would be hoisted out. Then you would be able to get your coals in or out equally as well when the ship was going 5, 6, or 7 knots as when she was at anchor, because it would be only a question of the seaworthiness of the boat. Admiral Selwyn has adverted to several points which certainly are extremely important, although perhaps not under discussion at the present moment. One was economy of fuel. I remember twelve or fourteen years ago, when some contracts passed through my hands, putting the point, which was very much criticized at the time, that no contract should be entered into by the Admiralty for engines until 1 h.-p. was obtained for every 1 lb. of coal consumed.

Admiral SELWYN: It has been done in my presence under the test of the dynamometer.

The CHAIRMAN: Captain Bedford Pim's ideas as to sailing ships must be looked upon as very retrograde. The "ironclads" he talks of did very good service at Alexandria, and had they been limited to their sails they would have made a very poor show indeed.

Captain BEDFORD PIM: They were but weak forts. I did not say confine the vessels to sail.

The CHAIRMAN: I have had the pleasure of commanding several of those ironclads, and I have not had more pleasure in a wooden ship than I have had in an ironclad. One of the great objections to this proposal, I think, is the vast space which would be wasted, I mean so far as stowage is concerned, by the air space required for each carrier. I have seen a good deal of hoisting things in tideways and so on, and I do not believe those carriers could be hooked on and hoisted in with a ship going 5 knots. Allowing for the ingenuity and thought which has been bestowed upon it, I can only say, as an old practical seaman, that it is not in my opinion practicable. As the greater part of this paper is devoted to the details of the construction and management of the carriers, I really do not know that I could occupy your time to any advantage by saying anything more about them, but what I do hope is that the discussion of this matter here, and possibly elsewhere, may lead to the appointment of one of those bodies of men which appear to be deprecated so much by Admiral Selwyn, namely, a Committee to consider the question. I believe myself in the usefulness of Committees. Probably I may be influenced in that opinion by having served on them myself;

but I do think that this is especially a subject upon which the appointment of a Committee to inquire into the whole matter, and to make suggestions and recommendations, would be extremely useful.

General LOWRY: You will not, I am sure, look for any comment at my hands upon the discussion which has taken place. I am glad to have had the privilege of reading my son's paper on this occasion, and I thank you for the great attention you gave it. I shall be yet more glad if—as Admiral Luard said—it tend in any way to call public attention to a matter of grave and pressing importance. Whatever may enable us more efficiently and promptly to coal our Navy will be a step in the right direction, and one on the accomplishment of which vast issues may hinge. It must needs not only affect the defence of that commerce of ours, which a nation that is not well prepared to defend will not long possess, but of those great Colonies of England which form her magnificent heritage in all parts of the world. I thank you much.

On the motion of the Chairman, seconded by Captain Pim, a vote of thanks for the paper was voted to Lieutenant Lowry, and to his father for reading it, and on the motion of Captain Jackson, R.N., a vote of thanks was passed to Admiral Luard for presiding.

The resolution was agreed to.

Friday, April 20, 1883.

LIEUTENANT-GENERAL SIR E. B. HAMLEY, K.C.B., R.A.,
in the Chair.

THE RUSSO-TURKISH FRONTIER IN ASIA MINOR.

By Major E. CLAYTON, R.A.

THE CHAIRMAN: I have the pleasure to introduce to you Major Clayton, who is going to favour us with a lecture on the present Russo-Turkish Frontier in Asia Minor. He has had peculiar opportunities for studying his subject, for subsequently to the Treaty of Berlin, according to a compact between our Government and the Turkish Government, British Officers were sent to Asia Minor to exercise some species of control and supervision, and Major Clayton was one of them.

I HAVE felt much hesitation in acceding to the request of the Council of the United Service Institution that I should read a paper on the new Russo-Turkish Frontier in Asia, on account of the very slight personal acquaintance that I have with the actual line of the frontier; but I was very loth to decline the honour done me by the request, and I have therefore endeavoured to bring together the principal considerations that seem to me involved in the frontier, and I hope there may be some among the audience who will kindly correct me if I have fallen into any errors.

Before coming to the consideration of the new frontier it may be as well to look first at the frontier as it existed before the war of 1877, and at the influence of that line upon strategical conditions, and then we shall be in a better position to understand the changes which have been brought about in these conditions by the new line.

The old frontier, from the Black Sea to Little Ararat, where it joined the frontier of Persia, was about 250 miles in length. Starting from the Black Sea, north of Batoum, it followed a ridge of mountains varying from 7,000 to 10,000 feet in height. Crossing the valleys of the Poskoff Tchai and Kura it continued along the watershed until it reached a small tributary of the Arpa Tchai, which it followed to its junction with that river. It then followed the course of the Arpa Tchai nearly to its junction with the Aras, or Araxes, and then turned south-west till it reached the crest of the range of mountains forming the southern boundary of the system of the Araxes, and continued along this ridge over the summit of the Greater Ararat to the Lesser Ararat, where it joined the Persian frontier.

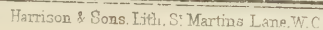
The number of routes leading across this frontier was not great. In the first place there was the coast road to Batoum. This was

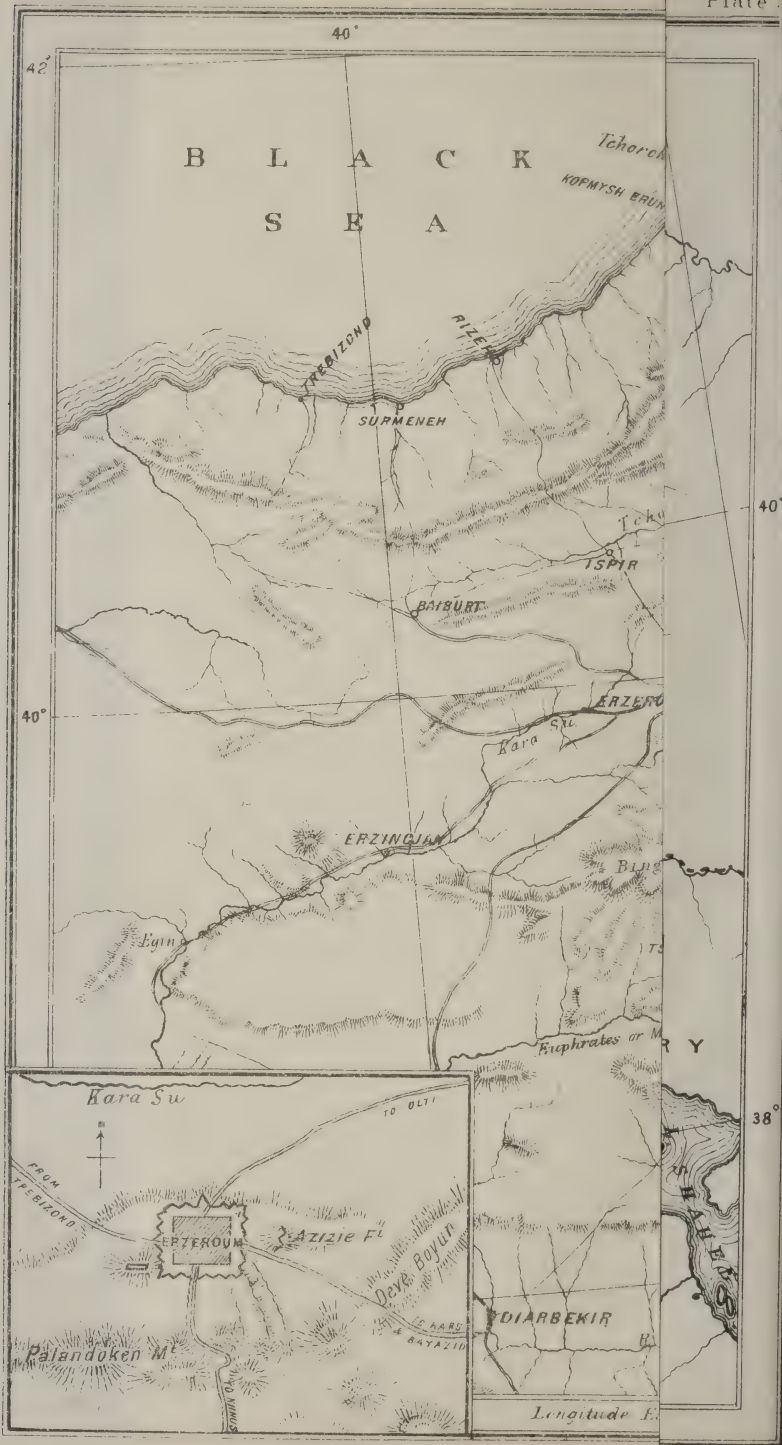
easily defensible against an enemy coming from the north, and in fact Batoum successfully resisted all attacks made on it during the last Russo-Turkish War. Next come the routes leading from Akhaltzik and Akhalkalaki on Ardahan. These were both difficult roads for any but small columns, and were closed on the northern side of the frontier by the towns of Akhaltzik and Akhalkalaki, and on the Turkish side by Ardahan. From Akhaltzik to the interior of the Russian province the route is through the Borjom Pass, a very narrow defile which could be easily closed. There is also a road from Akhaltzik *viâ* Akhalkalaki to Alexandropol. On the Turkish side of the frontier difficult routes led from Ardahan to Erzeroum, *viâ* Olti, and to Kars.

Next came the most important road of all, namely, that from Alexandropol, by Kars and the Soghanli Dagħ, to Erzeroum. This is by far the easiest road across the frontier, and in fact it has always been used as the main line of advance in all Russian invasions. On the Russian side it was closed by the fortress of Alexandropol, while on the Turkish side stood the famous fortress of Kars, which has always been considered of great importance, although experience has usually shown that it could be easily masked, and the real resistance to Russian invasion has been made at the Soghanli Dagħ. This range of mountains can be crossed by wheeled vehicles at several points, but nevertheless offers favourable positions for defence against an enemy coming from the north.

Farther east, again, there is more than one difficult pass across the range bounding the basin of the Araxes on the south, leading into the valley of the Murad Su, and a fairly easy pass leading from Igdyr to Bayazid, close to the western foot of Ararat. These routes are not favourable, however, to the operations of a force intended to act in the direction of Erzeroum and the Anatolian peninsula, on account of the exposure of the communications to a hostile force based upon the Lake of Van. During the recent campaign the Russian General, Tergukasoff, after his indecisive action against Mukhtar Pacha, at Eshek Khalias, was obliged to retreat on account of the advance of a Turkish and Kurdish force from Van on Bayazid.

On the whole, then, the old frontier may be considered to have been very favourable for defence against Russian invasion. Batoum secured the coast road and the difficult route up the valley of the Tchörök. Ardahan, if properly fortified and garrisoned, would have closed the roads by Akhaltzik and Akhalkalaki, and even when it fell it was difficult to move any large force by the route through Olti to Erzeroum. On the right flank, again, of the Turkish line the danger was not very great. A Turkish force at the Soghanli Dagħ would be on interior lines with regard to Russian forces advancing simultaneously from Alexandropol and Bayazid, and might defeat them separately, as happened in 1877; or a small force based on Lake Van might compel the retreat of the Bayazid force by acting on its communications. Therefore the main line of Russian advance must almost necessarily be from Alexandropol on the Soghanli Dagħ. Here the actual line of the frontier was not favourable for the defence, as was shown by the defeat of Mukhtar Pacha at the Aladja Dagħ. Any





position could be much too easily turned to be desirable as a field for obstinate resistance, but nevertheless an army assisted by the fortress of Kars would have favourable opportunities for delaying an enemy's advance until measures were taken for the defence of the Soghanli Dagħ, and for the security of Erzeroum; and then a probability would remain of successful resistance at the Soghanli.

The events of the last war were an illustration of this. The Russians failed to advance very far on either flank, though Ardahan was not properly held and fell at once, and Mukhtar Pacha was able to repulse the first attack on the Soghanli. But afterwards the error was made of attempting to hold the line of the frontier; Mukhtar was outnumbered, outflanked, and heavily defeated. After this he was no longer able to hold the Soghanli, but was obliged to fall back on Erzeroum. Before this city he tried to hold the position of Deve Boyun, but it was too extended for his force, and his army was driven into Erzeroum. This fortress held out till the close of the war, it was, however, winter, and the Russians were unable to bring up siege guns.

To turn now to the new frontier. It leaves the Black Sea at the promontory of Kopmysh, south of the mouth of the Tchhorok River, and runs up to the crest of the range of mountains dividing the upper course of the Tchhorok from the Black Sea. It then runs along this crest as far as a point a little to the south of Artwin, and then turns in an easterly direction and passes a little south of Olti to Karaurgan. From Karaurgan it passes between the villages of Upper and Lower Medjingerd, across the Araxes, to the crest of the ridge dividing the basins of the Araxes and Murad Su, just north of the Köse Dagħ, and from this point it follows the watershed until it reaches the old frontier at Mount Tendorak. The portion of territory thus added to the Russian dominions includes the port of Batoum, the lower part of the valley of the Tchhorok, which is navigable as far as Artwin, the head-waters of the Kura, the basin of Kars, and the Soghanli Dagħ.

We will now consider what effect on the strategic conditions this new frontier will produce. We have seen that under former conditions the only favourable line of Russian advance was that from Alexandropol *viâ* Kars and the Soghanli Dagħ upon Erzeroum. The actual frontier was hardly defensible, but facilities existed for delaying a hostile advance from the north until the Soghanli Dagħ could be strengthened so as to make a formidable position for defence. The forcing of this position should at all events have required a considerable time, and have delayed the enemy long enough to prevent him from appearing before Erzeroum before the short season suitable for active operations had come to a close. For it must be remembered that in these highlands, not less than 6,000 feet above the sea, the snow is not off the mountains till May at the earliest, and falls again in the latter part of November or beginning of December, and for six months at least of the year all transport of heavy guns would be impossible.

But what is the case now? Batoum is in the hands of the Russians, though it would probably not be used as a base for a serious advance into the interior, as the road up the Tchhorok Su by Artwin and Ispir

is extremely difficult, and not at all fitted for the movement of any considerable body of troops.

But it is different with the next route across the frontier. Ardahan and Olti are both now Russian, and the most difficult part of the road is within the Russian frontier, between Ardahan and Olti. From Tiflis to Ardahan the road is certainly carriageable, though probably difficult in parts in bad weather. From Ardahan to Olti the road is probably only passable for wheeled traffic in fine weather, but there is little doubt that the Russians are at work upon it and intend to make it a good road all the way. From Olti to Erzeroum is only a little over 70 miles, and although there is a bad pass over the Keretchli Dagħ it would probably be possible to get guns over it.

Then as regards the main road from Alexandropol by Kars, the Soghanli Dagħ is now in the hands of the Russians, and although the position at Zewin, where they were defeated in 1877, still remains to Turkey, yet it is within a stone's throw almost of the frontier. And as in any future hostilities it can hardly be doubted that the Russians will be most quickly prepared, they might advance across the frontier instantly war was declared, and seize this position. Then there would be nothing between them and Erzeroum except the position of Deve Boyun, which requires a large force to hold it, certainly not less than 25,000 men, and it would be very problematical if the Turks could collect that number, or anything like it, before the Russians could be upon them.

Therefore the Russians could now have two practicable lines of advance upon Erzeroum instead of one, and could collect their forces at their leisure at Olti, only 70 miles from Erzeroum, and behind the Soghanli Dagħ, with a communication between the two parts of the force *viâ* Bardez. And there would hardly be a possibility of the Turks being able to offer any effective resistance before the Russians could arrive in front of Erzeroum.

At the eastern extremity of the frontier the conditions remain much as before, except in the respects that will be alluded to later.

We have seen that no serious obstacle now intervenes between the Russians and Erzeroum. The question suggests itself, What powers of defence does Erzeroum possess? The city is situated at the northern foot of the Palandoken range of mountains, just where the ground begins to rise from the plain that stretches northward to the Kara Su or Western Euphrates. The town stands on the slope, so that its northern extremity is perhaps 200 to 300 feet above the plain, while its southern limit is 200 to 300 feet higher again. South of the town the ground continues to rise gently for about 2 miles to the actual foot of the mountains, which then rise very steeply. This ground is cut by the ravines of several torrents descending from the mountains, especially towards its eastern portion. Eastward of Erzeroum the mountains sweep round to the northward, and fall to the low ridge of Deve Boyun, or Camel's Neck, over which leads the main road from Erzeroum to Kars, and also to Persia *viâ* Bayazid. The city is surrounded by a rampart in the general shape of a square, and irregular in trace. The principal entrances are defended by small ravelins, but

there are no other outworks. There are two principal detached forts, one on a hill to the east of the town commanding the road over the Deve Boyun, and the other smaller one on a hill to the south-west of the town. There are no masonry revetments to any of the ditches, nor is there any bomb-proof accommodation. Moreover, large breaks exist in the *enceinte* in several places, so that in its present condition the place is not even secure from assault. I am not aware of the number of guns that are mounted. Independently of the weakness and insufficiency of the works now existing, the place is fully commanded by the ground south of the town between it and the Palandoken, and as far as I am able to see must fall within a very short time of a declaration of war by Russia. It may be said that in the late war Erzeroum held out for four months, and still remained in the hands of the Turks when peace was made. That is certainly true; but then it must be borne in mind that in that campaign it was not till the 4th of November that the battle of Deve Boyun was fought, and the Russians were able to appear before Erzeroum, and that then the weather would not allow of heavy guns being brought up. And again, Mukhtar Pacha's army, which took refuge in the fortress, though beaten was yet considerable in numbers, and composed of seasoned troops trained in many a previous fight, whereas in a new war the probabilities are that a very small force could be collected in time to meet the Russians. There is one *Corps d'Armée*, the 4th, stationed in the whole of Armenia and Kurdistan, about twenty-five battalions; but I know that many of these battalions, when I was in that part of the country, were not more than 300 to 400 strong, so that the *Corps d'Armée* could not consist of more than 10,000 infantry at the outside, scattered over a large space of country. No doubt a certain amount of time for preparation might be allowed, yet the Russian concentrations might be made easily and quietly along their good roads within a short distance of Erzeroum, while the augmentation and concentration of the Turkish troops would be much more difficult. Reinforcements of regular troops must come either from Anatolia by long marches over very indifferent roads, or by sea to Trebizond, and thence to Erzeroum, over a road which when first made was no doubt good but which has deteriorated to such an extent that in parts it is now scarcely passable by wheeled vehicles. I have myself seen wagons stuck axle-deep in the mire, so that the horses of several had to be harnessed to them one at a time to extricate them. And the Redif, or reserve, would take a considerable time to call out and organize. I believe, therefore, that the Russians would appear in front of Erzeroum within a very short time of the declaration of war, and while the Turkish army was still weak and disorganized. And it could be early in the season, so that plenty of time would remain for bringing up heavy guns. If the fortifications of Erzeroum had been sufficiently strengthened to be secure against assault it is possible that the Azizie fort might prevent heavy guns being brought over the Deve Boyun to the commanding ground south of the place, especially as it is so much cut up by ravines; but there is a road over the Palandoken mountains by which they might be brought. A long *détour* would certainly be necessary, and

the pass is difficult, but decidedly not impracticable, especially as the ascent on the south side is comparatively gentle and easy, and it is the north or descending side which is steep and where the principal difficulties exist.

I am therefore driven to the conclusion that Erzeroum must fall at an early period in any future campaign between Russia and Turkey, leaving plenty of time for further operations before the season became too far advanced, unless opportunity had been given and taken advantage of to make considerable additions to the defences of the place.

To give any reasonable prospect of Erzeroum offering a prolonged resistance it would be necessary to deny the enemy access to the commanding ground south of the place. For this purpose it would probably be necessary to construct supplementary works between the Azizie fort and the Palandoken, to secure the pass across this range and also to strengthen the south-western detached fort, and construct other works between it and the mountains in order to prevent an enemy reaching the commanding ground from the west. This he might otherwise do, either after having passed round the north side of the town from the Deve Boyun or after having debouched on to the plain by the road from Olti. It would also of course be necessary to repair the present *enceinte*.

A general view, then, of the probable course of events on a declaration of war between Russia and Turkey would, I think, present the following features: Firstly and principally, an advance by the Soghanli Dag, and probably also by Olti, on Erzeroum, followed by an early fall of that fortress. The Turkish efforts would, in all probability, have been centred in an attempt to save Erzeroum, and the way would have been left open for an advance also from Erivan on Bayazid, should the Russians so desire.

It may be well here to cast a passing glance at the nature of the country bordering on the frontier on the Turkish side. The principal features of the Armenian highlands may be thus described. The surface of the country is generally hilly, in many parts mountainous; but scattered about among the hills are a number of plains of greater or less extent. The hills and mountains are, as a rule, rugged and stony, and are uncultivated, being used only for pasturage. In the spring a greenish tinge creeps over them from the growth of grass and numerous flowering herbs; but as the summer, which is almost entirely rainless, goes on, the vegetation becomes dried up, and the whole landscape presents only various tints of brown and red. The plains are, as a rule, very fertile, and in those cases in which the streams that flow through them can be diverted for irrigation purposes, plentiful crops of cereals are grown. But in some parts the streams have worn for themselves such deep ravines in the soft strata, that their waters cannot be used for irrigation, and in these cases the crops depend, to a great extent, on the amount of snow which falls in the winter and soaks into the soil when melting, and upon late rains in the spring; and when these fail, as was the case in 1879, the year I went out, deficient harvests and famine are the result. The geolo-

gical formation of many of the plains consists of a great series of thin-bedded, marly clay-stones, the degradation of which forms a fertile soil, but one which bakes very hard in the sun, and which apparently does not retain moisture very long, and therefore requires irrigation or late rains. Such are the plains of Erzeroum, Pasin, and Khnus, and others of less importance. But some other plains, such as that of Boulanyk and others of less extent on the western shore of Lake Van, have been formed by the degradation of soft lavas which have been poured forth from the great volcanoes of Sipan, Nimroud, and others. The soil so formed, though very light and powdery in appearance, seems to retain moisture better, and these plains are therefore less dependent upon the seasons, and their crops seldom if ever fail altogether. There is yet another type of plain, of which a considerable part of the great plain of Mush is an example, where the soil is a deep alluvium, and this also retains moisture well, so that the crops on it are less precarious. The mountains are also of different types. Some of the great ranges, such as the central Kurdistan mountains, are principally formed of mica-schist and other metamorphic rocks, the strata being tilted up at a very high angle, with occasional outbursts of basalt, porphyry, and other igneous rocks. Other masses, usually of minor extent, are formed altogether of outbursts of igneous rock, and others again are formed of sub-crystalline limestone, while others are extinct volcanoes pure and simple, of which there are several near the Lake of Van, and others between Van and Bayazid. The country as a whole may thus be divided into the hilly regions of pasturage and the agricultural plains. The population may also be broadly divided into corresponding classes. The hills are usually occupied by the Kurds, who are predominatingly pastoral, while the agricultural Armenians occupy the plains. But this can only be considered as a broad generalization. There are many Kurdish villages in the plains, and in the central Kurdistan mountains the Kurds and Armenians are intricately intermixed, while in the very highest mountains south-east of Van are found the Nestorian Christians, certain tribes of which enjoy something approaching to independence through the extreme difficulty of communication with their narrow valleys hemmed in by very lofty and steep mountain-ridges.

Of wood there is a great lack throughout a large part of this tract of country. The ranges bordering on the Black Sea bear luxuriant forests, but when once these ranges are crossed the eye may travel over the country for scores of miles in every direction without resting on a single tree. The Soghanli Dagħ has forests, but these have now passed into Russian hands, and not a stick is found growing in all Turkish Armenia, except in the enclosures in the immediate neighbourhood of a few towns and villages, until the central range is reached. On the northern slopes of this range considerable quantities of a scrub-oak, interspersed with dwarf cedars, are found, and, as one penetrates into the interior of the mountains, the forests become more extensive, and the trees of larger growth.

Such being the general aspect of the country, the opening of the events of a new Russo-Turkish campaign, as I have sketched them

out, would place Russia in possession at once of the plains of Erzeroum and Pasin, and in great probability also of Alashgerd, the basin of the head-waters of the Murad Su or Eastern Euphrates. In each of these a fair amount of supplies would probably be forthcoming; but it must be remembered that from the effects of war, famine, Kurdish depredations, and the exactions of the Turkish officials, the population has been diminishing and getting poorer, and the extent of land under cultivation has been getting less, so that these plains, fertile as they are, can now not supply anything like the amount of food-stuffs that their natural capabilities would promise. The country round Bayazid would not be able to supply much, but it would be easy there to procure supplies from the rich plain of Erivan, or even from Persia.

If these would be the probable results of the first events of a campaign, the next point is the course likely to be subsequently pursued.

Let us first note the principal routes leading from the country supposed to have come into the possession of the Russians, into the interior of the Turkish dominions, or which might be used by the Turks for bringing up reinforcements.

In the first place there is the road from Trebizond to Erzeroum. This would be the quickest way the Turks could bring up troops, supposing they retained the command of the sea. The character of the road has already been mentioned.

Next comes the post-road from Constantinople through Amasia and Kara-Hissar. This is joined by a road from Kaisariyeh, thus communicating with the southern portion of the Anatolian peninsula.

Next comes the road to Erzinjan, and thence by Egin to Diarbekir, or by Sivas to Kaisariyeh.

Of these the post-road to Constantinople is certainly practicable for wheeled vehicles, but I have not enough information to be able to speak with certainty about the other routes.

Then comes a route from Erzeroum to Diarbekir by Tchabakchur. This passes through a very wild country and is difficult, and utterly impassable for six months in the year.

Next there is a road from Erzeroum to Mush by Khnus. The wagon-road makes a circuit through the Pasin plain, but there is a shorter route over the Palandoken mountain. This would not generally be used for wheeled traffic, but it would not be impossible to get guns over it. The ordinary road is easy, and continually traversed by bullock-carts. It passes first the Pasin plain already spoken of, and then that of Khnus, where supplies should also be plentiful. Mush is situated at the northern foot of the central Kurdistan range, and looks over the splendid plain of Mush, watered by the Murad Su and its tributaries. From this route another good road branches to Bitlis, passing through the very rich plain of Boulanyk, and then along the strip of ground between the great volcano of Nimroud and the beautiful Lake of Van. Bitlis is a large town of some 40,000 inhabitants, situated in the narrow valley of one of the tributaries of the Tigris, and is a place of considerable business, being on the high road between Mesopotamia and the Armenian highlands.

Next comes the post-road from Erzeroum to Van, which passes by Melasgerd and the north of the lake. This is also a road practicable for wagons, though difficult in places.

All the above routes diverge from Erzeroum, or its immediate vicinity. Going further east the next route is from Alashgerd down the valley of the Murad Su to Melasgerd, and thence through Boulanyk to Mush and Bitlis, or to Van. I have no certain information about the road from Alashgerd to Melasgerd, but when I was once at Melasgerd I was told it was a fair road. The roads through Boulanyk and to Van are good.

Lastly there is the route from Bayazid to Van. This route passes over very high ground, is impracticable for wheeled traffic, and dangerous in summer to the traveller on account of the frequent raids over the Persian frontier. When I passed it eighteen months ago, on my return to England, I was obliged to have an escort of some twenty Kurds, in addition to the Turkish zaptiehs. In winter it is entirely closed by the snow.

Let us now examine what would probably be the further operations of the Russians. They might apparently have either of two main objects. Firstly, an advance on the Anatolian peninsula, and finally on Constantinople; or, secondly, the entire subjection of Armenia and Kurdistan, and the acquisition of the outlets into Mesopotamia and Syria.

Suppose the first of these were their object. Before advancing much further it would be necessary to secure their communications, which, if they advanced from Erzeroum, would obviously be exposed to an enemy posted anywhere in the direction of Mush, Bitlis, or the Lake of Van. It is only five or at most six days' march from Mush to Erzeroum, so that a force might be collected in the rich plain of Mush, which could place itself in a very short time on the Russian communications. If the Turks retained command of the Black Sea it would be especially necessary for the Russians to protect their communications well, because the whole reinforcements and supply of their army would have to be carried out along this single line. If the Russians should get command of the sea this would be of somewhat less importance, as they might form subsidiary bases at the various ports along the northern coast of Anatolia as the army advanced. In view of this sensitiveness of the Russian line of communications it would probably be sound policy for the Turks, at the opening of the campaign, if not in a position to meet the Russians with a fair promise of success in front of Erzeroum, to retire towards Khnus and Mush, after throwing a sufficient garrison into Erzeroum, rather than to retreat towards Constantinople. They would thus hinder the Russians from advancing perhaps more effectively than by frontal resistance, and oblige them to employ so large a force in operations to secure their communications as to seriously diminish the numbers available for the main operation.

Therefore it would appear that the Russians, after the capture or the masking of Erzeroum, must operate towards Mush and the Lake of Van before they would be able to advance with safety towards

Constantinople. If their main object were the second alternative mentioned, namely, the subjection of Armenia and Kurdistan and the gaining possession of the outlets into Mesopotamia and Syria, they would have to operate in the same direction. It would therefore perhaps, not be uninteresting to consider the general features of the country south of Erzeroum and between Lake Van and Mesopotamia.

Let us then suppose we are going from Erzeroum to Mush. The most direct way, and that usually taken in summer by travellers on horseback, leaves Erzeroum by its southern side and crosses gently rising ground to a gorge in the Palandoken mountains. It proceeds up this for a mile or mile and a half, and then turning to the left rises steeply up a spur, and winding round the head of the gorge reaches the crest of the mountain. From this crest a wide view is obtained of rolling hills, covered more or less with herbage, stretching away to the south till the prospect is bounded by the Bingöl Dagħ, a long smooth ridge rising to some 10,000 feet above the sea, on the upper slopes of which patches of snow remain all the summer. No sign of habitation or cultivation is perceived. Over and among these hills the road takes its way, here and there passing a poor village in a valley with scanty patches of cultivation round it. Several streams are crossed, and then the Araxes is reached in the neighbourhood of Külli. At this point the route under consideration is joined by the wagon-road which leaves Erzeroum on the east, and crosses the ridge of Deve Boyun, rising some 800 to 1,000 feet above the plain of Erzeroum. On the east side of this ridge the road descends into the Pasin plain. From this plain diverge the roads to Kars by the Sogħanli Dagħ, to Bayazid *viâ* Alashgerd, and by Külli to the regions bordering Lake Van. The Araxes, which is here a considerable stream, is crossed by a ford at Külli. A bridge also exists 2 or 3 miles lower down. From Külli the road to Van *viâ* Melasgerd branches off. Shortly after passing the the Araxes the road crosses a ridge connected with the Bingöl Dagħ, on which a defensive position might be found, but it could be turned by a circuit to the east. From this ridge the road descends to the wide plain of Khnus, which takes its name from a village and castle situated on one of the numerous streams which flow from the Bingöl Dagħ, and have cut deep ravines with perpendicular walls in the plateau. Most of the houses are built at the bottom of the ravine, which may be 200 to 300 yards across; but the old Genoese castle stands on the upper edge of the cliff overlooking the plain. This was the furthest point reached in this direction by the Russians in 1877. The plain of Khnus is cultivated and rich, but liable to suffer from drought. The road to Mush crosses this plain, having on the right hand the Bingöl Dagħ and on the left a range of hills separating the plain from the valley of the Murad Su. After crossing the Kizil Tchai by a ford the road ascends these hills, which are of a rolling character, and give pasturage in summer to the Kurds, and descends to the Murad Su near the neat Circassian village of Tcharbuhur. Then the course of the Murad Su is followed on its right bank passing through a range of hills by a gap which might be defended. A castle stands on an isolated hill at its further end, where

it debouches into the great plain of Mush, thickly dotted with villages and bearing good crops, though much of the land is not under cultivation. Beyond the plain are seen rising, steep and rugged, the main range of the Kurdistan mountains. The Murad Su is crossed by a bridge which was once a fine structure of twelve arches, but now all the arches except three have been destroyed, though the piers remain, and very bad wooden spans have been substituted. In their present condition they would not bear guns, but could be repaired by engineers possessing timber, but none could be obtained in the immediate neighbourhood. In the height of summer the river is fordable, though even then rather deep. Mush stands on the steep slopes at the mouth of a gorge in the mountains, and is very picturesque, but dirty and unhealthy, and the Moslem inhabitants are very fanatical. It is the seat of a Mutessarif; population about 15,000. The great plain of Mush contains a population of about 50,000, of which about 36,000 are Armenians, and the bulk of the remainder Kurds, with a few Turks, Circassians, and Yezidis. Below the plain of Mush the Murad Su passes through gorges along which runs a very bad road to Kharput.

The road from Khnus to Bitlis passes across the very fertile plain of Boulanyk, through which also the Murad Su flows, but which is divided from the Mush plain by a range of hills of moderate elevation, rising about 1,000 feet above Boulanyk, and 1,500 to 2,000 above the Mush plain. The road then crosses a ridge connected with the extinct volcano of Belidshan, and passes the Nazik fresh-water lake, and then descends to the shores of the great Salt Lake of Van, along which it proceeds to the south-western extremity of the lake. In the right of the road rises the great crater of the Nimroud Dagħ. It is possible to ride up the mountain on the side facing the lake, and on reaching the lowest point of the summit ridge, some 2,000 feet above the level of the lake, one finds one's-self on the edge of a vast circular crater, between 4 and 5 miles across from lip to lip. The sides descend very steeply for 700 or 800 feet below the lowest point, and the bottom of the crater is occupied by a flat broken dome, among the hollows of which, and in the ring between it and the sides of the crater, are a number of tarns, one at least of which has several hot springs rising in it. Part of the floor of the crater is covered with birch scrub and creeping yew, which are valuable in this treeless region, and it is for the bringing of the wood to the villages that the road has been made into the crater.

From the south-west angle of the Lake of Van the road mounts on to a plateau called the Rahwan, lying between the Nimroud Dagħ and the Kurdistan mountains. This plateau lies only between 400 and 500 feet above the level of the lake, but in the winter it seems to be the meeting-place of storms, and is very dangerous to cross in unsettled weather. I have myself seen from 6 to 8 feet of snow lying on it in the last week of March. It is apparently formed of lava which has flowed from the Nimroud Dagħ, and it seems to me to be possible that this lava-flow has been the origin of the Lake of Van. Beyond the plateau to the west lies the flat alluvial plain of Mush, about 1,000 feet lower than the present level of the lake, and it would seem at all

events not impossible that the basin where the lake now is was once drained through this plain into the Euphrates until the outlet was blocked by the lava. Vast sheets of lava have been poured out from the Nimroud and Belidshan Daghs, which by their degradation have formed fertile soils. A great sheet of black lava has also been poured out on its north side by the Sipan Dagh, the highest mountain in these parts, which rises in a superb isolated cone on the north of the lake for some 7,000 feet above its level, and whose summit is covered with perpetual snow. From the Rahwan the road descends a narrow valley for a few miles to Bitlis.

The Lake of Van is a most picturesque sheet of clear blue water, about 80 miles in its greatest length and 40 in its greatest breadth. Its surface is nearly 5,500 feet above the level of the Black Sea. On its southern shore it is hemmed in closely by the mountains, which rise in many places very steeply from its very edge, so that the road from Van to Bitlis is forced inland in some parts, and in others is a mere ledge on the steep hillside, quite impracticable for wheeled vehicles. On the west of the lake lies the Nimroud Dagh, and on the east is the not very extensive plain of Van, backed by a fine rugged mountain called the Warak Dagh. North of the lake the hills recede from its borders and are lower, so that the Sipan Dagh may rise in its solitary grandeur; several rivers run into the lake, but it has no outlet.

After this glance at the nature of the country let us turn again to the problems of a campaign. After the fall or masking of Erzeroum, I can see nothing to prevent the Russians from overrunning the whole of the country between Erzeroum and the Lake of Van. Defensible positions may no doubt be found on any of the roads, but the whole country is easily traversed by cavalry and infantry, and routes may certainly be found practicable for guns by which any position might be turned; so that it does not seem probable that if the Turks were not able successfully to meet the Russians before Erzeroum, they would be able to do so before the latter reached the northern base of the central Kurdistan range. But when this limit is reached very different conditions are met with. This range is a very formidable obstacle to the passage of troops. None of the roads across it are good, and most of them are extremely bad. The route from Erzeroum to Diarbekir, by Tchabakchur, has already been mentioned as very bad. Next come two routes from Mush through the Sassoon mountains. I have crossed the easternmost of these. It is excessively difficult. There are ascents and descents of 3,000 to 4,000 feet, the sides of the valleys are extremely steep, and it was with the greatest difficulty that I could get my baggage animals along in some places. The interior of these mountains is so difficult of access that the Turkish authority is not much more than nominal. When I passed, the Pacha of Sert was encamped in one of the valleys near the southern limit of the range with a small force of infantry and cavalry and two mountain guns, endeavouring to collect taxes from the Kurds, who had paid none for ten years; but I was told that he had been threatened with armed resistance if he attempted to compel payment. The Kurds in these parts are very wild and uncivilized. Each valley is at feud with all

its neighbours, and no one dare go out of his own valley. The Pacha, in addition to two troopers, caused a chief to provide me with an escort of his men, to my first halting-place, there to be replaced by others. On arriving at the village where I was to spend the night, the old chief received me with cordiality, and showed me a place to pitch my tents, and invited the Kurdish escort to sleep in his house. But they came to me and begged that they might be allowed to sleep outside my tent, as they were afraid of being murdered if they went into the village. There are a number of Armenians scattered about among these Kurds who are in a state of complete serfdom. They are considered to be under the protection each of a certain chief, who is supposed to prevent any one from injuring them. In return for this they must give him anything he wants, and ask his permission to marry, or even to buy new clothes, and have to make presents on the occasion. If a chief wants money he sells some of his Christians to another chief, who probably squeezes the purchase-money out of the victims themselves who are sold. But the villages are a pleasant contrast to the heaps of squalid hovels that one sees in the plains. The houses are generally substantially built of stone, and surrounded with the greenest fields and orchards, wherever a patch of level ground can be found, this vegetation forming a most striking contrast with the deep red and brown tints of the mountains. Some of the southern valleys are well wooded also, and very picturesque. The other route from Mush I am not personally acquainted with, but it is probably not much better, though I believe that during the Circassian immigration from Russia it was passed by families with their furniture and bullock-wheeled carts.

Next comes the route from Bitlis to Mesopotamia. The main caravan road passes through Sert, but though so constantly traversed is very hilly, rough, and bad—quite impassable by wheeled traffic in its present condition. There is another route which descends the whole way by the Bitlis river, which is said to be better, and which was used in the Circassian immigration. But even that is bad, and guns could not be taken by it without work being done on it.

If then the Russians wished to secure their communications previous to an advance through Anatolia they would probably occupy the country between Erzeroum and the Lake of Van as far as this range, driving any force the Turks might have there into the mountains, where they would hardly be able to follow them. The Russians would by this means also obtain the supplies of the rich plains which form the granary of the Armenian highlands. But if the Turks were enabled to deny the entrance into the mountains to the Russians the latter would have to leave a considerable force at the foot of the range to watch the passes, especially if the Turks were able, as they ought to strain every nerve to do, to retain possession of the plateau of the Rahwan at the head of the Bitlis valley. This would act as a *tête-du-pont* at the debouchure of the caravan route from Mesopotamia, under cover of which reinforcements might be pushed up from the south. To guard against danger to their communications from this point, the Russians would probably have to leave so considerable a force as to

seriously cripple any army that they would be likely to dispose of from Transcaucasia. And for the Turks to push up troops this way, landing them in the Gulf of Iskenderun, or at Antioch, and marching them *viâ* Aleppo, Diarbekir, and Bitlis, would be a very good scheme of operations in view of a Russian invasion, giving the means as it would both of arresting indirectly the enemy's march westward and meeting directly operations for the subjugation of Kurdistan and the acquisition of the entrances into Syria and Mesopotamia.

For now the second main object the Russians might have in view remains to be considered. The country and routes west of the Lake of Van have already been touched upon. There remains to be noticed the country east of that lake. And here a good deal would depend upon the attitude of Persia. If the Russians were debarred from Persian territory they would have great difficulty in penetrating south in that direction. Bayazid can be reached by an easy pass practicable for heavy guns, but south of that the difficulties begin. Immediately south of Bayazid rises a steep range nearly 3,000 feet higher than the ground below, over which the road passes, and on which the Turks held a position in 1877. This would be a formidable position to attack, and if possession of it were obtained it would require very great labour to get guns up to it; but after that was done there would be no very serious obstacle to be surmounted before reaching Pergri, at the head of the north-eastern arm of the Lake of Van. Of course if the Russian main object were to annex this district a force which has crossed the Soghanli Dag, and thence marched by Melasgerd to Pergri, would soon render the position south of Bayazid untenable by threatening the communications of the force holding it. From Pergri there is a choice of routes to Van. The principal of these, which can be passed by wagons, follows the shore of the lake. There is also a frequented track that passes by Ertchek, but this is not practicable for wheels, a steep ascent having to be surmounted from Pergri. A favourable position for defence would be found on the heights south of the basin of Pergri, blocking the roads to Van. If this were forced many bye-paths are found besides the main tracks, so that any position could be turned, and further prolonged resistance would be difficult north of Van. Van is a city of some 30,000 inhabitants, of whom 20,000 are Armenians and 10,000 Moslems. The city proper lies in a plain about a mile from the lake, at the southern foot of a curious isolated rock of limestone, about three-quarters of a mile long, highest in the middle of its length and gradually declining to each extremity. This rock slopes steeply to the north, but its southern face is perpendicular. In this face are a number of rock-hewn chambers, associated in some instances with cuneiform inscriptions. An old castle stands on the rock with several tiers of walls on the north side, but it would offer but little resistance to a modern army accompanied by artillery. A double wall and ditch surrounds the town, but is utterly useless for defence. The main bulk of the population, however, do not live in the town, but in suburbs called the Gardens, which stretch for a considerable distance south and east of the town, and consist of orchards and

vineyards surrounded by mud walls. Among these orchards and vineyards the houses are scattered. The Gardens are commanded, to a very great extent, by a detached chain of rocky hills to the north, and altogether the place is incapable of defence. But south of Van the country becomes extremely difficult. The chief route to Mosul passes by Bashkala, the plain of Gevver and Shemdina, the country of Sheikh Obeydullah, about whom so much has been heard. A pass nearly 10,000 feet high has to be passed between Van and Bashkala, where a very strong position might be found, but the remainder of the route as far as Bashkala is fairly easy. Between Bashkala and Gevver, however, the road passes through gorges where the path is a mere track at the very edge of a torrent, and beyond Gevver is a very labyrinth of high and steep mountains and narrow ravines.

There are several other tracks across the mountains leading from Van to the valley of the Zab, or to that of the Bohtan Su, but they are most of them of extreme difficulty. One route that I took from Van to Sert by Khizan is fairly good for pack animals, passing through a magnificent country, abounding in game. There are rugged peaks, sweeps of forest and sparkling streams, and the basin of Khizan, to outward appearance, might almost pass for the happy valley of Rasselas. Coming to it from the north over a sandy ridge it lies at your feet like a park backed by a lofty range of snow-flecked peaks. Corn and rice-fields are diversified by clumps of trees and grassy knolls; there are hedges like those of an English lane, bright with wild roses and other flowers, while the clearest streams dash foaming over their rocky beds. But the road passes for miles along ravines and gorges, through which it would be almost impossible to force a way against armed resistance, and camping-places are few and far between.

The difficulties of penetrating south by the east of the Lake of Van are therefore very great, unless Persia allowed a passage through her territory, in which case the difficulties of passing the Kurdistan mountains might probably be circumvented. But this opens up a question beyond the scope of the present paper.

The general conclusions, then, to which the considerations I have been permitted to submit to you seem to point I think are these:—

1st. In the event of war breaking out again between Russia and Turkey the Russians would have no great difficulty in obtaining possession of Erzeroum and overrunning the country to the south-east of that place as far as the central Kurdistan range.

2ndly. Before an advance could be made by the Russians westward from Erzeroum, it would be necessary for them to secure their communications from danger threatened by any force that might be in the neighbourhood of the Lake of Van, or that could be pushed up from the south by Bitlis.

3rdly. If the Russians wished to get possession of Armenia and Kurdistan, and secure the passages into Syria and Mesopotamia, they would find serious difficulty in penetrating the central Kurdistan range; and

Lastly. It would be of great importance to the Turks to secure the possession of the plateau of the Rahwan and the head of the Bitlis

valley. As long as they held this position they could bring up troops from the south, and a force here would block the best route through the mountains, and would be in a position to threaten the Russian communications, whether they advanced westwards from Erzeroum or attempted to penetrate the Kurdistan range either from Mush or Van.

The CHAIRMAN: As there does not seem likely to be a discussion, it only remains for me to return our best thanks, in which I am sure you will all heartily concur, for this excellent and instructive lecture. In the course of it it has been evident that Major Clayton has brought to his task not only considerable local knowledge and great power of arranging it and presenting it to us, but also a degree of professional training and familiarity with strategical subjects, which could alone have enabled him to present to us so lucid a picture of the state of the case as now existing between Russia and Turkey. On the one side we have the great grasping power of Russia, with her numerous army, well appointed, well officered, well organized, resting on great cities and strong fortresses, with good roads to conduct it to the frontier; and on the other side we have the crumbling Empire of Turkey, without money, without men, without heart or hope. I can testify to the general truth of Major Clayton's picture, because I was the Commissioner appointed to represent Great Britain for the delimitation of this particular frontier. When, in accordance with the Treaty of Berlin, a Russian and a Turk were to meet here for the purpose, it was stipulated by our Government that a British Officer should be joined with them, chiefly to protect the interests of Turkey, because nearly all the preceding year had been wasted, in consequence of the persistent efforts of Russia to gain more advantages and more territory than the treaty gave her. I entered the country with my party at Trebizond, following the road which Major Clayton has briefly described—a road passing over formidable passes, very often for many miles together a mere notch cut in the precipitous sides of lofty mountains, and descending from thence for thousands of feet into close valleys, which, with the melting of the snows, were filled with roaring torrents, so that in the year I travelled there, nearly all the bridges were swept away, and our wagons had to pass these rivers by fords, going up and down the broken banks. I need hardly say how very precarious such a route must be for the support of an army operating at the other end of it. One chief object of my mission was to secure for Turkey the strong position of Zewin, and all the preceding year the Russians had endeavoured to encroach upon this position. However, it was secured to Turkey and still belongs to her; but I need hardly say that a position is of no great value without a suitable garrison, and to secure that position there ought to be a strong force permanently encamped there. I doubt very much, even supposing Turkey had the men, whether the country affords the means of maintaining that force at that particular spot. These circumstances show us how this unfortunate country has been going down hill since the most ancient times that we have any knowledge of; for we know that thousands of years ago Xenophon led 10,000 Greeks through this country: he went up by Bitlis, close to Lake Van, and traversed the country between Erzeroum and Trebizond, and although he could not scatter his forces in order the more easily to obtain supplies, because he was everywhere pressed by the barbarians and had to move in compact order so as to be always ready to fight, yet he has recorded that all along that line of road he found plenty of subsistence for his troops. It would be quite in vain to hope for anything of that kind now, and taking that fact, and also the many others which Major Clayton has laid before us, I think it must be evident that it is merely a question for Russia herself to determine when she shall overrun and annex a considerable part of this Turkish territory. Whatever reason we may have for wishing to make ourselves better informed on this subject in a scientific and military point of view, I think you will all admit that the labours of Major Clayton have given us ample means of studying the subject, and pursuing it to the best advantage.

Friday, April 27, 1883.

SIR THOMAS BRASSEY, K.C.B., M.P., Lord of the Admiralty,
in the Chair.

MARITIME POWER AND ITS PROBABLE APPLICATION IN WAR.

By Captain R. H. HARRIS, R.N.

THE attainment of supreme maritime power has been jealously striven for, and dearly prized when attained, by nearly every nation that has had any pretence to a seaboard. But much as it has been sought and valued, and greatly as it has enriched, from time to time, those who have been its proud possessors, yet it has been at the most only a transient power, and its successive owners have, after a hard struggle to retain their mastery of the seas, usually been obliged to yield what they so much valued to some other powerful nation whose people have made a determined effort to secure maritime supremacy.

Hence, in spite of our undisputed possession for a long period of the greatest maritime power that has so far ever been created, it behoves us to narrowly watch every fact or circumstance connected with our navies, and to neglect no means that may help to ensure our being most thoroughly prepared to encounter with success any attack which might have for its object the destruction either of our Colonial Empire, or the enormous mercantile marine on whose untrammelled labours we are so dependent, and of which we may be so justly proud.

For have we not good reason for assuming that a serious reverse to our maritime power would in the first place almost immediately transfer our carrying trade to a neutral flag, and in the second place, if the reverse were not speedily checked by some decided success on the part of our fleets, that our small outlying possessions would soon become a prey to our enemies, and also that our vast Colonies, notwithstanding those feelings of loyalty or affection which might attach them to us, would, in their own interests, and for their own safety, feel compelled to declare their separation from a mother country which was no longer able to protect their sea coasts and shipping?

To be then thoroughly prepared to avert such a catastrophe it is surely needful that we should carefully ponder and consider what best constitutes maritime power in the present day. Replete with difficulty is this question,—to it must be given our utmost energy. Next in importance to this must be our knowledge of the most skilful manner of applying to war purposes those classes of vessels which for the time we may have assumed to compose our maritime power.

In these days the possession of such power may be, in a greater or

less degree, attributed to those nations who have the ability to send afloat a well-manned, well-found, and efficient force of powerful armoured or protected ships, with a corresponding force of corvettes, fast cruisers, and other vessels wherewith to satisfy their own national requirements in time of war. Against this, we may say that maritime weakness is with equal certainty to be ascribed to any nation which, without an adequate force of war-ships, has a large mercantile marine scattered all over the globe, with extended commerce, and possessing many outlying and unprotected dependencies.

From the above it may perhaps be definitely stated, and I believe generally accepted as a fact, that a maritime Power with small commerce on the seas, &c., has, at the outset of a war, far less to fear than her enemy, who, with an equal war navy, has a large and extended mercantile marine, &c. The latter has much to lose by defeat; the former has little to lose, and much to gain if victorious.

We may thus admit every unit of a mercantile fleet, with the exception of its fastest steamers, to be a national weakness in maritime war; also that every unfortified town or Colony on a seaboard is another weak point open to the attack of an enterprising enemy; but we may fully recognize every fortified seaport, more especially if it is available as a coaling station, to be a source of maritime power, and an unqualified strategical advantage. In it, cruisers could coal with rapidity and safety, merchant ships could be assembled to await convoy. A well-situated port of this kind could be utilized as a valuable base from which to carry on naval operations, both for the protection of our own or for the destruction of an enemy's commerce.

It has been well and sufficiently demonstrated by the American Civil War that the Confederate States, which could in no manner be classed as a maritime Power, found means during the course of their desperate struggle to literally destroy, or drive to the cover of a neutral flag, the whole of the large mercantile navy of the Federal States. And yet it must be owned that it was the maritime power of the Federal States, when more fully developed, which was the main cause of the eventual subjugation of those gallant Confederates. Is not this a lesson to ourselves, that however great our maritime resources are, yet we dare not delay the development of the power they give us until war is actually declared?

The geographical position of a country has naturally much to do with the position it occupies as a maritime Power. To an insular nation like ourselves, dependent on the foreigner to buy the manufactures which give employment to the many hands in our over-populated land, and, in return, to sell us the daily food, which our soil is incapable of growing for us, the necessity for great maritime power may be said to have reached its climax.

We must, indeed, acknowledge maritime power to be our very life as a nation; without it, our present mercantile prosperity and material wealth must inevitably dwindle to a much lower level.

If, however, supreme maritime power is a necessity for us, and entails some sacrifice on the part of our people to preserve it, does it not free them from that burden of universal conscription for military

service under which our continental neighbours continually groan? And at the same time does it not provide us with an unequalled scientific frontier, which we can extend or retract at our pleasure? While it rests solely upon the goodwill of the supreme maritime Power whether other nations shall trade freely on the high seas or not, can we with safety ever let such power slip away from us, and feel sure that a successor would continue to use it with the same justice and moderation which we can fairly place to our own credit?

Fortunately for the continuance of our national greatness, we have at our feet all the elements that are necessary permanently to secure it: we have an innate patriotism, a race of brave and hardy seamen; we possess the most skilful naval architects and engineers, in conjunction with abundance of all the materials necessary to construct, equip, and propel our vessels of war; we have coaling stations in nearly every part of the globe; and lastly, we have that noble inheritance, bequeathed to us by the traditional valour of our forefathers, a naval prestige that has hitherto been unequalled in the annals of the world. This being so, surely the decline of our maritime power can only result from some extraordinary neglect in its proper application on our own part.

Let us then never lose an opportunity of considering how we can best consolidate and preserve this power, which under God's providence has been the true source of our national prosperity. Our task is no easy one. For years past, nation has been striving against nation with ceaseless ingenuity, as to who shall build or acquire the most powerful vessels of war. It is this strife which has resulted in a constantly increasing thickness and strength of protective armour, with its often varied and more skilful adjustment, in the extraordinary growth in the size and power of guns, in the introduction and rapid development of torpedo warfare,—it is this which has added to the war-navies of the world an almost infinite variety of vessels, differing most essentially from each other in type, size, class, speed, and power. Each design possesses some particular feature which renders it, as the case may be, either weaker or more powerful than some otherwise corresponding vessel; indeed, it has become a momentous question for the naval administrators of to-day how they are to best expend the money placed at their disposal by their country, so as to ensure it being converted into those vessels which will give the greatest possible amount of maritime power; and it becomes an equally momentous question for the seaman how he is most advantageously to employ the ever-varying engines of maritime war with which he is entrusted.

I therefore venture to think that an attempt on my part, however feeble it may be, to group some of the varieties of war vessels, with the object of bringing their powers, and, generally speaking, probable application, under discussion in this Institution, will not need any apology.

It is manifestly impossible, however, in the time allowed for a paper of this kind, to name and discuss the numerous varieties of vessels in detail.

I should wish here to mention for a moment what has especially induced me to read this paper: it has been the numerous thoughts

which occurred to my mind during the reading lately of the paper entitled "Battle-Ships, a Forecast," by Mr. Barnaby, in this theatre,¹ and the discussion which followed, but more particularly by the carefully prepared and thoroughly instructive diagrams, in the use of which Mr. Barnaby gave so much point to his remarks.

By their aid the comparative maritime power of nations could be seen and comprehended at a glance, and I feel sure that many of my brother Officers who were present must have been, like myself, somewhat awestruck at the comparative magnitude of our commercial marine, and at the same time impressed with a sense of the terrible responsibility which may possibly some day, in great measure, rest upon themselves of giving due protection to such a large preponderance of helpless merchant shipping.

In the course of his remarks Mr. Barnaby fully directs attention to the many conflicting difficulties which the naval architect has to reconcile, and in his concluding remarks he states that "the questions raised in his paper which seem to be debatable are—

"1. Should England build ships greatly exceeding, in speed, coal-endurance, guns, and armour, existing ships of the first class, regardless of size and consequent cost?

"2. Will not the enemy's ports require to be attacked and blockaded, notwithstanding the torpedo? and, if so, what description of ship will be suited for this attack?

"3. Ought regular ships-of-war to be built of sufficient power and speed to capture ships like the 'Servia' and 'Alaska,' and their larger and faster successors? or should we not rather look to the services of such ships for the work, endeavouring to fit them for it?

"4. When the powers of the ram and the torpedo come to be tested in actual warfare between two Great Powers, what part may we expect to be assigned to the fast gun and torpedo ship with protecting deck, and the merchant auxiliary, as a result of these contests?

"5. Ought the battle-ship of the first class to carry guns of the largest calibre which can be made and worked? or should we be content to allow the gun to progress slowly with the advance of the armour?"

Let me frankly admit that a direct and positive answer to these questions is more than difficult—it would be mere egotism on my part did I attempt so to answer them; yet I hope that this paper, which by your kind permission I now have the honour to read, may, by inducing further discussion, be the means of helping to ventilate, if not to partly answer, these five questions which have been propounded for us by Mr. Barnaby.

In every discussion of this sort, concerning the actual elements of our maritime power, we may at least hope to derive some benefit or instruction, even if we cannot absolutely determine what best constitutes it, or lay down any hard and fast rule as to its probable application.

Solely then for the purpose of approaching our subject, permit me

¹ Journal, vol. xxvii, No. CXIX.

to temporarily separate our war-vessels into classes, irrespective of the fact that several of these classes, so selected, are capable of being employed in conjunction with one another to their mutual advantage.

1st. Sea-going armour-clads or protected ships capable of a sea-going speed of 12 knots.

2nd. Sea-going armour-clads or protected vessels of less speed.

3rd. Armour-clads not sea-going.

4th. Frigates, corvettes, and sloops.

5th. Armed merchant steamers of high speed.

6th. Gun-vessels, gunboats, and despatch vessels.

7th. Torpedo vessels and boats.

I separate the armoured vessels, and in the first place select those of 12 knot speed for this reason.

There is no greater truism than that the speed of a fleet is governed by the speed of its slowest ship; hence, to deal a bold and decisive stroke for the mastery at the very commencement of a naval war, such a blow must be struck by swift vessels: the delay of having to wait for a slow ship or two might be fatal to the best laid plans of an Admiral who was desirous of closing with his enemy.

It would indeed be a terrible thing for the Chief of a fleet to have his enemy in sight, and while burning with ardour to engage them, yet be unable to do so, through simple lack of speed.

Any higher speed than 12 knots would be most advantageous could it be attained. With the swiftest vessel, or the swiftest fleet, lies the option of giving battle or declining it, of choosing when and where to fight, of electing whether the battle shall at first be limited to artillery alone. Changes of wind will not, as of yore, influence the combatants; there is no weather-gauge to strive for.

Let us for a moment realize the importance to ourselves of a naval victory won in the early days of a maritime war, and also reflect on the disastrous consequences sure to ensue, both to our shipping and Colonies, if this battle could not be fought, or were unsuccessful. A victorious sea-fight on the first outbreak of war, or our enemy driven into port and blockaded, we should be at leisure to develop, and bring into play, the enormous latent maritime power which it is our good fortune to possess.

Promptitude in maritime war will ever be our greatest national economy.

It may be asked, Why do you not designate or select any particular type of armour-clad or protected vessel, with which to compose this 12-knot fleet? I would reply that I have no intention of doing so, independently of any personal bias or opinion I may have as to the merits of certain vessels, and, apart from special qualifications or defects, I regard all armoured vessels, capable of manœuvring at 12 knots speed, as important adjuncts to any fleet. We are not justified in presuming that a fleet battle of to-day would be lost or won by artillery alone; on the contrary we have ample evidence that the impact of the ram, and the shock of the torpedo, must play a very important part during the *mêlée* which must surely ensue during a hotly contested naval action. Certainly, then, if the power of individual

ships consists of artillery, ram, and torpedo, and that either arm may be used with success, we must not disqualify any vessel from the fight by reason of her being inferior in gun power, or protective armour; for granting that she is the inferior of some in these respects, yet may she not be the superior of many in the employment of the other weapons?

In the single combat of armour-clads it might be different; there, in addition to speed, the weight of metal thrown, the angle of training of guns, the strength and position of protective plating, may all be fairly taken into account before the ram and torpedo—the same of course in an attack by armour-clads on forts and batteries; but in the fierce heat of an actual sea-fight, fleet or squadron attacking fleet or squadron, then may we partially neglect the number and weight of guns and the strength or skilful adjustment of protective plating, and assume, providing the speeds be equal, that the more numerous fleet will have the greatest advantage.

The French Rear-Admiral Aube, in his celebrated article on Naval Warfare, &c., says: "*A fleet superior in numbers will be, from the commencement of hostilities, mistress of the seas;*" and "*The empire of the sea, in the strict meaning which we must give to those words in the present day, belongs to the most numerous ironclad fleet.*"

It would thus seem that the safest means of preserving or acquiring maritime power on the part of any nation will be, not to split too many straws over the individual capabilities of certain vessels, but to take care that there be no deficiency in numbers of moderately capable vessels all possessed of good speed.

Can anybody positively state that a force of ten armoured vessels of the very first class, which may be fairly valued at seven or eight million pounds sterling, are the equals in a sea-fight of fourteen or fifteen armoured vessels of the second class, of the same speed, and also valued at the above sum?

To carry our argument a few steps farther, and look ahead a little more than it is perhaps quite wise to do, let me ask if the same ten first-class armoured vessels are the equals of five armoured vessels combined with fifteen or sixteen protected torpedo and gun vessels, all of equal speed and of the same equivalent value?

Here we have twenty-one ships against ten; we presume all the speeds to be equal; we acknowledge that the torpedo power of each vessel may be the same, and the proportion of ramming power also to be twenty-one to ten. Is it not possible that the superior gun power and armour-plating may be insufficient to counterbalance the disproportion of the other weapons?

The above argument is of course capable of being carried to a much greater length in the same direction, and it will still be favourable to the more numerous vessels.

It would, however, be unfair to armoured or protected vessels of the "Lepanto" type to deny the advantage their extreme speed and unequalled power will give them in single combat, or to question the great strategical power they possess, when attached to a fleet, of bringing to action the sternmost vessels of an enemy who was bent on

declining battle; but the possible easy disablement of such costly monsters of the deep, by vessels of insignificant size and comparatively trifling cost, should make the most thoughtless reflect as to the wisdom of placing too much dependence on, or being content with, a navy composed of a few such Leviathans.

It seems more than probable that if in the immediate future any fleet-battles have to be fought, they will be contested on the old historical naval battlefields, either in our Channel, the Mediterranean, or in the waters of the West Coast of Europe; the want of adequate coaling stations will forbid our possible foes from quitting these seas. A stray armour-clad or two may have to be encountered further afield, but I do not foresee any possibility of the repetition of a long chase, like Nelson's pursuit of a French fleet, to the West Indies and back.

It is self-evident that in an engagement, either between squadrons or single ships, the squadron, or ship with the highest speed, will always have the choice of position in which to commence an action, and in the first place also have the option of confining the fight to artillery. The faster vessels, or vessel, can, by selecting a retreating action, always keep out of the way of the torpedoes or ram of slower antagonists. I do not wish to recommend such a manœuvre, but we may find our enemies resort to it, until, proving artillery insufficient, ram and torpedo would be employed.

Any ship having a preponderance of 2 or 3 knots speed over an enemy could, in single combat, after manœuvring for a retreating action, have the advantage, by repeatedly yawing, of delivering broadside after broadside into her enemy, who, while vainly striving for closer quarters, has only the use of such guns as she can fire right ahead.

We have few actual data upon which to construct in imagination the fleet-battle of to-day; but there are a few facts which may help us to gather an idea of what is most probable.

One thing we know is, that the complete independence of wind and weather which steam has given us renders it almost impossible for two hostile fleets to blunder suddenly into sight of each other. We may know also that the tactics of the Nile or Trafalgar are equally impossible: no enemy of the future will await our attack, either at anchor or lying to at sea.

We may reasonably expect that two hostile fleets, having decided to submit their destiny to a battle, will mutually seek each other under the cover of widely extended look-out vessels, which vessels on meeting will gradually be forced back on one side or the other, signalling the information of the enemy's approach.

Should both fleets be equally courageous, and determined to dare the closest battle, then it is apparent that they must face each other, and for a time pass and repass through each other's formation, endeavouring the while to deal destruction with ram, gun, and torpedo, the uninjured reforming again as quickly as possible to repeat their charge with similar intent—continuing thus until an excess of casualties, or a weaker courage, had reduced this terrible combat into a *mêlée* or a flight.

But should one of two hostile fleets, meeting, feel confident in their artillery, and at the same time possess a superior collective speed to their adversaries, then its Chief may manœuvre, as I have before hinted, to limit the action to artillery alone; this may be successful for a time, but it must, should the slower fleet determinedly insist on closing with their enemy, eventually come to a pursuit. Matters having reached this stage, we may suppose that the Chief of the pursuing fleet unable to close bodily with his foe, will advance his fastest vessels to bring to close action the sternmost ships of the enemy: this strategy, if at all successful, would probably result, as before, in a *mélée* as already described.

In these latter moments of the sea-fights of the future, a very prominent part will, I believe, be taken by swift rams and torpedo vessels; when the fury of armour-clad is concentrated on armour-clad, amidst the roaring of escaping steam, and the din and confusion of a heavy fire and its consequent clouds of smoke, then will exist the opportunity for small swift vessels to wreak destruction upon their larger foes: it is in these moments that numbers will tell more than individual strength.

In single combat, a fast ship need never be rammed by a slower ship,¹ but if the steering powers are equal, the faster vessel may always ram the slower vessel. In ships of equal speed, the ship of the best turning power can always avoid the ram of a more unwieldy vessel.

As Whitehead torpedoes can now be ejected from vessels to travel at the speed of 20 knots for a distance of 200 yards, they may, in a measure, be said to flexibly extend the ram to that distance.

A torpedo, towed astern of a vessel that feared being rammed by a handier vessel than herself, would be a great safeguard; the Captain of the ramming ship would naturally fear that a frustrated attempt to ram his adversary might carry him over the torpedo astern of her.

The next element in importance to fast sea-going armoured vessels would be their slower sisters; these will be assembled and hurried off in the wake of their faster comrades, whom they must support and reinforce, as much as their speed will allow, or form a reserve on which the fast vessels could fall back.

In a closely contested fleet action, the early appearance of a reserve on either side would decide the battle. At the end of a successful sea-fight, we know not how many of the victors may be able to keep the sea; but we do know that the consequent damages to ships, from gun, ram, and torpedo, must at the least be a matter of tedious repair, either in dock or basin.

It is not probable that armour-clads will be employed as blockaders in the immediate vicinity of ports known to contain torpedo vessels, more especially at night; on the contrary we may suppose that the actual blockade will be conducted by lighter and swifter vessels, who being cognizant of the daily position of the armour-clads to whom they are attached will repeatedly communicate with them, keeping

¹ See Captain Philip Colomb's Prize Essay, 1877, "Gun, Ram, and Torpedo."

them apprised of any movements on the part of the blockaded. In some blockades an opportunity may be afforded the blockaders of establishing themselves in an adjacent harbour, and using it as a base for their operations.

It is difficult to say what would be the first application of non-sea-going armour-clads at the outset of a purely naval war: except for the protection of harbours (where their mobility would certainly render them more valuable than fixed forts), their duties would be limited; but when the first blow had been struck home, and a blockade established, then the dormant aggressive power of these ships might be brought to the front, and they may be wisely employed to bombard an enemy's forts in preference to their faster and much more costly companions in arms.

We should remember, in estimating maritime power with regard to any of the vessels hitherto mentioned, that what the power is at the commencement of a war so it will remain: it may diminish, but not increase; the long period required to construct and engine an armoured ship precludes the possibility of a ship being laid down and sent afloat during the course of a modern war; it may also be confidently assumed that the complicated machinery of a war-ship will require frequent repairs, and it is next to hopeless to expect all such vessels to be continuously efficient under the severe strain of actual war service.

With the view of developing the full maritime power of a squadron or fleet of armoured vessels, it is necessary that they should be largely supplemented by vessels of other types. The paper I had the honour of reading in this theatre last June¹ enters more fully into this matter than I can have time to do this afternoon, but I hope it may be sufficient if, in the course of my remarks on unarmoured vessels, I mention those which are, in my opinion, most suited to supplement an armoured fleet or squadron.

Frigates, as known in the olden days of our naval supremacy, can now hardly be said to exist, though indeed all our earliest armour-clads were denominated frigates. Yet they were undoubtedly built to take the place of line-of-battle ships; therefore, apart from armour-clads coming under the denomination of frigate, though carrying their guns on the broadside and principal armament on the main deck, we may name the "Shah" and "Inconstant" as types of the frigates of the day. These magnificent ships are, however, not likely to be used in any number in the maritime wars of the future: the expense of their construction is great, and it seems hardly justifiable to leave such large and costly ships without some protection for machinery and guns.

Their place will probably be taken by fast and powerful corvettes.

In estimating the maritime power of any nation, a sufficient force of these vessels must rank next in importance to a well found and sufficient force of armoured vessels.

It will be hardly possible to enumerate all the war services that will be required from corvettes in time of war: they must be the eyes of an

¹ "The Necessity of Supplementing Armour-clad Ships by Vessels of other Types." Vol. xxvii, No. CXIX.

armoured fleet; they must drive the cruisers of an enemy off the seas; they must unceasingly pursue, capture, or destroy the merchant shipping of an enemy, wherever it is to be found; they must be stationed as guards on those spots where, from natural causes, our ocean highways narrow; in those regions where during passages our merchant shipping is wont to congregate, there too must be the cruising corvette.

This class of vessel will have to be constantly seen off our important colonial harbours, to give confidence to the inhabitants, and to deter the enemy's cruisers from attempting to lay tribute on seaport towns.

To get a full idea of the manifold duties that will be thrown upon our corvettes and cruisers during a severe naval war, it is necessary to refer to the truly admirable paper on "Naval Intelligence and Protection of Commerce in War," read by Captain J. C. R. Colomb, in this Institution (see Journal, vol. xxv, No. CXII).

The greater part of these duties could be effectively executed by corvettes of from 12 to 14 knots speed; but for the look-out duties first mentioned, and for capturing the fast cruisers that might be employed by an enemy, corvettes of a higher speed are necessary.

As the services of corvettes are of the greatest importance at the first outbreak of a maritime war, it is evident that they are an element of maritime power, the construction of which cannot be delayed until a war is expected or declared, not even if it is a fact that the rapid strides naval architecture is making will render many of them obsolete before their services are required for war purposes.

Their extreme value in a dilemma would amply reimburse the cost of constructing those corvettes whose best days may have gone by during an era of peace.

The one great necessity of corvettes in war will be coal: constant cruising and pursuit will soon empty their bunkers; an adjacent coaling station will be to them a source of continual strength.

If a class of sloops could be constructed of sufficient speed and coal-carrying capacity, many of the duties which I have just relegated to corvettes might be economically assigned to them; but, so far, I fear this class of war vessel does not exist; the majority of our own sloops, though they may be eminently fitted for police duties in foreign waters, during peace, or for doing battle with a barbarous country, yet, in actual war with a civilized and enterprising nation, would be found too slow, either to efficiently protect our own commerce or destroy that of an enemy.

In our large and magnificent merchant steamers of high speed, of which, when compared with other nations, we rejoice in such a happy preponderance, will be found another large element of maritime power well within our grasp.

The wisdom of our Admiralty in preparing armaments for these fine vessels cannot for a moment be contested; in their own interests alone, even if not required during a war, to assist the Royal Navy, the mere fact of these vessels being armed would prevent their falling

an easy prey to similar swift vessels, which might be employed by a foe to attack our commerce.

Their high speed and vast steaming capacity would render two or three of them, if attached to an armoured fleet, most invaluable allies.

If we happened to be at war with some nation which was so much inferior to us, in actual maritime power, that her only chance of successfully injuring us afloat would be by endeavouring to destroy our mercantile marine by fast steamers, in this case we could well afford to hunt down each of the vessels so employed, with two or three of our own armed merchant steamers, and thus speedily terminate their career.

But it is well that we should guard ourselves from falling into the error of supposing that these vessels are capable of successfully engaging the war-built vessels of an enemy: their weak structure must always effectually prevent such a thought.

It is also well to remember that should we ever have the dire misfortune to meet with naval reverses, then these fast steamers would be the only sure means of supplying our teeming town populations with daily food, and they could hardly be diverted from this important service for war purposes.

We may fairly assume that fast steamers like the "Alaskas" and "Servias" of our mercantile navy could run cargoes from port to port with almost perfect immunity from capture, while our immense fleet of slower steamers would have to change their flag, or be compelled to undergo and endure the delay of being convoyed.

The importance of keeping open our high road to India and the East *viâ* the Suez Canal cannot be denied; should it, however, be threatened or attacked we must rely on our fast steamers for keeping up a rapid line of communication *viâ* the Cape of Good Hope. Indeed, in the event of war with a Mediterranean naval Power, it appears to be desirable that a portion of our trade with the East should be at once so diverted.

The "Servia" and "Alaska" of to-day and their improved sisters of to-morrow are capable of steaming from Plymouth to Bombay *viâ* the Cape under thirty-five days, allowing them five days of this period for coaling and unavoidable detention on their passage.

In gun-vessels, gunboats, and despatch vessels is comprised another element of maritime power; it is needless to say much about the latter vessels: they, as their name implies, would be principally employed during war in carrying despatches with rapidity and keeping up the communication of fleets; many vessels capable of these duties would be easily obtainable by us in war, and torpedo vessels and boats will also be available for this service.

The function of the gunboat proper, in the ordinary sense of the term, is during times of peace to economically represent the national flag in foreign ports, up rivers, and shallow harbours which are un-navigable by larger craft. Many and important are the services they thus render to this country; but for ocean service, such as the protection or destruction of commerce, they appear to be next to

useless : sailing vessels would be their only prey, and the fast cruisers of an enemy would always avoid engaging them. These vessels, when belonging to the weaker of two belligerent naval Powers, would probably, during the course of a war, seek the shelter of a neutral port.

Gunboats of the "Staunch" class may be regarded as useful vessels for the defence of harbours, where their heavy guns and light draught of water would be of great service ; a combined attack by a number of these craft on an enemy's forts would be very formidable.

But apart from these ordinary types of gun-vessels and gunboats, with which we are familiar, a larger, faster, and much more powerful type has been found possible, and it is likely to be generally introduced as a new element of maritime power. Such vessels were described by Sir William Armstrong in his address upon our national defences ; their performances are well known, and have been often quoted : with a displacement of 1,300 tons they have a speed of 16 knots, and are armed with two new type 10-inch guns, capable of penetrating 18 inches of iron armour.

We may be sure that we shall not rest here, and that the designs of these vessels will be much improved upon : their high speed, heavy guns, and torpedoes will be a serious menace to the powers of armour-clads ; and an armoured fleet supplemented by vessels of this character will have its offensive powers developed in an extraordinary degree. On the able application of this sort of vessel in conjunction with torpedo vessels, must armoured fleets rely for the efficacy of their blockading powers. The immense cost of our present armour-clads, and their limited number, will never admit of their being unnecessarily pitted, under, perhaps, disadvantageous circumstances, against comparatively ignominious, but none the less dangerous foes. So we may say, when it is wise to withdraw the blockading armour-clads from the vicinity of a blockaded port, then will it be necessary for the swift gun-vessels to close in and freely risk their own existence, to ensure a proper observance of the blockade, or to give timely warning of a sortie.

It would need a separate paper to enter fully into the momentous question as to the effect on maritime power, and its application, of the general introduction of locomotive and stationary torpedoes, or of torpedo vessels ; these latter, and the rapid strides we may expect them to take in the next few years, seem to me the maritime question of the day. It is even possible that armoured vessels of large size may at some future time completely succumb to greater developments of torpedo vessels. In the present it will certainly be most judicious to largely supplement armoured fleets, by both torpedo vessels and boats, each armed with Whitehead torpedoes ;—the torpedo vessels to be capable of independently keeping the sea ; the torpedo boats to be attached to the armoured vessels, or carried by steamers like the "Hecla" fitted as torpedo depôts.

There can be devised no more effectual way of harassing an enemy's coast than by repeated torpedo attacks on his harbours, and the power which such a ship as the "Hecla" would have of repeating these attacks on ports, perhaps some 200 miles apart, one day after

another, and always where least expected, could not fail to exercise a demoralizing effect on the most obstinate foe.

Many valuable opinions have been freely expressed, that torpedo warfare will be of more benefit to defensive than offensive operations. This may have been so at first, but it now appears probable, from recent progress, that in due course, apart from the bugbear which stationary mines must always be to huge and costly vessels, torpedoes will be fully as effective weapons in the hands of the assailants as they have hitherto been reputed to be in those of the assailed.

Stationary mines are of equal use to block a foe in a port as to keep an enemy out of it, and in the wars of the future we may in great measure expect torpedo attacks to take the place of those gallant cutting-out expeditions for which our naval ancestors were so famous.

With regard to the fifth question which Mr. Barnaby has given us, like the others it would be difficult to satisfy it with a direct or short answer. However, in estimating the size of gun with which to arm ships of the first class, it is important to remember, what past experience has undoubtedly shown us, *i.e.*, that light guns and slow ships soon become obsolete, but that fast ships and heavy guns have a much longer life of usefulness; fast ships, if lightly armoured, yet mounting heavy guns, are always the equals of other ships which have more protection, but less gun power. And again, where heavy armour would be useless, gun power is the best defence against attacks of torpedo vessels and rams; to my mind it is better to have a ship well armed than well protected.

In conclusion, I would say that I venture to think there is no cause to tremble now for the future of our maritime power, any more than there was when the transition of our fleets from sailing ships to steamers was imminent; then we can remember frequent predictions, both at home and abroad, that the introduction of steam was to end our maritime supremacy, and that by it we should be brought on the same level as those peoples who are naturally less maritime than ourselves.

So far we may well congratulate ourselves on the falseness of these predictions; and if the next transition of our fleets should be from a few monster armour-clads to vessels both smaller and swifter but much more numerous, then again, I think, provided we are true to ourselves, that we may still look hopefully forward to a long continuance of that great maritime power which has made our nation the subject of the mixed admiration and envy of the whole world.

Admiral Sir ERASMUS OMMANNEY: Much credit is due to Captain Harris for this very comprehensive paper. It deals with many questions, each of which might give rise to a long discussion; but on the whole, I think, naval Officers generally will very much approve of it. I am glad to see that he contends very strongly for speed. Speed is one of the greatest elements we require for our hostile operations in future. I think I gathered that he limited battle-ships to 12 knots, but I think we ought not to contend for less than 14 knots at the present day. There is only one observation that I should wish to make with regard to increasing our naval force,—the method is somewhat indirect, and at variance with free trade principles,—but my idea is to prevent the construction of ironclads in this country for foreign Powers. As soon as we construct a war-ship of super-excellence, we see the engineer

skill of this country building something surpassing it to supply foreign nations with. The subject is one very difficult to handle, but still we always have that to contend with—that is, that we are supplying foreign nations with the means of assailing ourselves. I think the paper is very valuable, and there is little that I desire to comment upon in a critical spirit.

Mr. RAVENHILL, C.E.: I feel somewhat diffident in rising in this Institution and in the presence of an assembly of naval Officers; but I venture to do so, being anxious rather to draw your attention to what I take to be our great weakness, viz., our commercial steam marine. Mr. Barnaby, by his very interesting paper and instructive diagrams, I believe, set many gentlemen who heard him thinking about the weakness of it, who, perhaps, had never given much thought to it before. He showed us in one of his diagrams, a small block, representing the number of merchant vessels having a speed of 14 knots and upwards on the Admiralty list, and it occurred to me that it might be interesting if an endeavour were made, and I have ventured to make it, to subdivide his large square block of steam-ships, so that you gentlemen should know the class of vessels employed, particularly in carrying cargoes to and from our shores at the present time, and it would be those vessels that you might be called upon to convoy and protect. The data I have worked with is based on the Parliamentary Return issued only two days ago, viz., the Annual Statement of the Navigation and Shipping of the United Kingdom for the year 1882. Of the vessels employed in the Home trade I find 1,402 vessels under 1,000 tons; those, no doubt, are principally employed in the coasting service, and many will continue in that service unless we entirely lose command of the sea. Those 1,402 vessels represent a displacement tonnage of say 373,188 tons. Coming to the Home and Foreign trade, I find that under 2,000 tons, which appears to be the limit of size employed on such services, there is a total of 305 vessels with a displacement tonnage of say 218,379 tons. In the Foreign trade, which includes all those of 2,000 tons and upwards, there appears to be a total of 2,470 vessels, with a displacement tonnage of say 4,129,012 tons, giving therefore a gross total of all classes of vessels of 4,177, and a displacement tonnage of say 4,720,579. The accompanying combined diagrams and tables show you the relative tonnage in the form of rectangles, and the number of vessels in their respective classes. Captain Harris alludes to fast vessels, such as the "Alaska" and the "Servia," and the possibility of their services being required for supplying our daily food, &c. The Admiralty have, apparently, to a great extent, absorbed these 14-knot vessels, because in Mr. James Dunn's paper on Bulkheads, read at the last meeting of the Institution of Naval Architects, he stated there were 157 vessels qualified on the Admiralty list. Now, there are only about 209 vessels in existence above 2,000 tons, and therefore the grave question would arise, Can the commercial steam marine stand the loss of the services of these 157 vessels? There were other points upon which I should have wished to address you, but I am reminded I must not occupy more time.

Admiral GORE JONES: I should like to make a few remarks on one special point. All through this very thoughtful paper which Captain Harris has read to us, and for which we are exceedingly obliged to him, there is one word which occurs oftener than any other, and that is "speed." The coal-carrying has been carried to the utmost excess in ships to try and get continuous speed, and, no matter what the size and capability of the ship, the one thing we all demand is speed. Now there is one element which recent experience has brought particularly to my mind, and that is the absence of docking power for England in the world generally, wherever she has got work to do. I was on the Indian station, and there is not a single dock in the whole of our Indian Empire that would take a first-class frigate or an ordinary troopship, and ships are constantly coming home from India without fans, and otherwise incapable, through the fact of not having a single dock. Now, to keep up speed, an ironclad requires to be docked at least every six months, and if she is not docked, she loses her speed completely. In the "Euryalus," my flagship, I could go 17 knots over the ground, with a clean bottom; and when she was six months old, or foul, I could only go 13, and that with difficulty. Now, as I see a Lord of the Admiralty in the chair, I should be very glad to bring this point particularly before you, because it is one of far greater importance than the

NUMBER OF STEAM VESSELS with their Displacement Tonnage (exclusive of River Steamers) actually employed belonging to the United Kingdom in the Home Trade, partly in the Home and partly in the Foreign, and in the Foreign Trades respectively, remaining on the Register, 31st December, 1882.

Displacement Tonnage.		
108,166	A	3,000 tons register and upwards.
249,450	B	2,500 to 3,000 tons register.
420,570	C	2,000 to 2,500 tons register.
641,584	D	1,500 to 2,000 tons register.
846,982	E	1,200 to 1,500 tons register.
640,641	F	1,000 to 1,200 tons register.
609,404	G	800 to 1,000 tons register.
227,478	H	700 to 800 tons register.
150,468	I	600 to 700 tons register.
92,554	K	500 to 600 tons register.
80,964	L	400 to 500 tons register.
35,029	M	300 to 400 tons register.
17,032	N	200 to 300 tons register.
6,915	O	100 to 200 tons register.
1,263	P	50 to 100 tons register.
512	Q	Under 50 tons register.

The Diagrams show the Total and Relative Displacement Tonnage of the several Classes.

NOTE.—Attention is drawn to the relative proportion of Displacement Tonnage in their respective Classes, but more particularly to those from 800 to 2,000 tons register, and the very large number of Steam Vessels afloat belonging to them, having an aggregate Displacement Tonnage of 2,776,042 tons out of a total belonging to all Classes of 4,720,579

These vessels, if under steam in a Convoy could not be taken to have an average ocean speed of more than about 8 knots per hour.

IN THE HOME TRADE.			PARTLY IN THE HOME AND PARTLY IN THE FOREIGN TRADES.			IN THE FOREIGN TRADE.		
Displacement Tonnage.			Number of Vessels.	Displacement Tonnage.		Number of Vessels.	Displacement Tonnage.	
108,166	A		21	108,166	A	21	108,166	A
249,450	B		61	249,450	B	61	249,450	B
420,570	C		127	420,570	C	127	420,570	C
641,584	D		249	641,584	D	249	641,584	D
846,982	E		422	846,982	E	422	846,982	E
640,641	F		388	640,641	F	388	640,641	F
609,404	G		454	609,404	G	454	609,404	G
227,478	H		193	227,478	H	193	227,478	H
150,468	I		155	150,468	I	155	150,468	I
92,554	K		112	92,554	K	112	92,554	K
80,964	L		119	80,964	L	119	80,964	L
35,029	M		66	35,029	M	66	35,029	M
17,032	N		44	17,032	N	44	17,032	N
6,915	O		35	6,915	O	35	6,915	O
1,263	P		11	1,263	P	11	1,263	P
512	Q		13	512	Q	13	512	Q
218,379	GROSS TOTAL.		305	218,379	GROSS TOTAL.	2,470	4,129,012	GROSS TOTAL.

NOTE.—For the relative proportions of the Diagrams these Displacement Tonnage of a Vessel is taken to be one-and-a-half times the Registered Tonnage.

manufacturing of engines or carrying coal. A vessel with a foul bottom cannot have speed, and consumes a much larger quantity of fuel, and therefore I would particularly call your attention to the absence in India of an ordinary dock capable of taking even a first-class frigate or a troopship.

C. PFOUNDEN, F.R.G.S., &c. : The possibility of successfully applying our maritime power in time of war depends far more upon the brain and muscle that guides and controls the units of that power, than upon the type of such units of guns and ships. Therefore I would ask to be permitted to make a few brief remarks on this ; for, although it has not been dealt with in the able paper before us, the question of the *personnel* is really at the foundation of all maritime power. With 45,100 men in our navy, Coast Guard service, and Indian troopships, 12,400 Marines, and a Reserve of nominally 18,000, we have only some 1,300 or 1,400 Volunteers (R.N. Artillery). We have in the shipping clearing from home ports, also, some 200,000 men, British and alien, in which we find nearly one foreigner to every five Englishmen, and of the 50,000 in those on colonial and foreign coasts, there are many entire crews of Lascars, Chinese, Kroomen, Kanakas, &c. Foreigners are permeating our service as Masters, and to a greater extent as Mates, and I confess I strongly resisted, at the Shipmasters' Society recently, these aliens entering our British Shipmasters' Society. The decline to five men per 200 tons (about one-half the proportion, before the age of big ships) is most marked. It is true there are many small vessels in our Colonies, and some 12,000 of them at home, of an aggregate of over 1,000,000 tons, with say 40,000 men, or an average of 80 to 90 tons and three to four men each. There are also, *on paper*, 12,500 indentures, but these are officially stated to be practically cancelled. The replies of the shipowners (*vide* Blue Book) to the inquiry of the Greenwich School authorities, exhibit a deplorable state of affairs ; boys are refused on all sides, by many owners absolutely and altogether, whilst others demand high premiums, and almost prohibitory conditions are exacted. Is it to be wondered, therefore, that in thirty years the percentage of aliens has risen from 3 to 16 per cent. of our crews ? So the question is, Where are our seamen of the future to come from ? We cannot even now depend upon getting them, for our ships-of-war, from the Mercantile Marine. If we would but consider the standing navy, in whatever form it may be made to assume from year to year, on a peace footing, as the nucleus of our possible requirements for war purposes, Officers and men, and youths, could be maintained in large numbers, and in a high state of efficiency as to seamanship, gunnery, &c. ; and most economically elsewhere, than on board of costly, huge, ironclad machines. On this point I must not now enlarge ; the last few numbers of this Institute's Journal, and that of the British Association, contain my views, based on special personal observation amongst seamen in many parts of the world. Not a few distinguished and experienced Officers hold, I am glad to say, similar opinions. We cannot remain as we are till a war is actually imminent. The national naval spirit and gallantry, exhibited even in the mercantile seaman of the past, must not be allowed to fade for ever from amongst us. Else, where will our seamen come from ? for we cannot denude our valuable merchant ships of their best men, by suddenly calling up the Naval Reserve. Good trustworthy men for the look-out, and capable helmsmen, are too scarce ; there is a great difficulty in obtaining able seamen ; so we must call into existence some means of cultivating a wider area to select seamen from. We must have Volunteer Blue Jackets, even more numerous than our nominal 200,000 Riflemen, &c. Manning our ships at home (*vide* my paper at British Association, Southampton), and also in the Colonies, is the really important question. This is an Imperial responsibility, and a national duty ; we owe it to ourselves, and to our kin across the sea ; and we must fulfil this duty. We shall be met more than halfway, right royally, by our loyal Colonial compatriots. We cannot copy the French maritime inscription, but surely we may find out and adopt a better method, and one more efficacious. We must not only encourage the building of better merchant ships, without in any way unduly checking or interfering with shipbuilders and owners. We must also, and above all, speedily inaugurate steps to encourage the shipping and maintenance of a better class of men for the crews, and the placing on a more satisfactory footing every way, our merchant marine, and it would be criminal neglect upon our part did we solely rely upon our present sea-going fleet of war-ships. More local ships,

that may be used for training and rendezvous, are wanted. There is, again, this risk: our astute enemy might buy up many of our very best ships before we knew it; but could not this be, to a certain extent, precluded? And what we would have to pay as bonus—say for right of purchase, or as subsidy—might be reimbursed us by certain privileges, as to the use of them for training a certain number of junior Officers, seamen, and youths. It is not heavy, obsolete, pattern guns that should be put on board these vessels, but light guns of long range, and a high, penetrating potential. Self-defence may have to be provided for, but not necessarily at close quarters, as in the case of our fast ships meeting a more powerful enemy. Then questions as to condensation of fuel, utilization of products of mineral fuels, economy in firing up (stoking), moderating speed unless when absolutely necessary to put forth full energy, and thus fleet vessels can be economically worked. The Russian purchases during many years, those of the Japanese, the Chinese, and other nations, furnish us with most ample practical experience that we should fully utilize. The various types, whether the “Armstrong” (Chinese), “Rendel,” “Inconstant,” “Iris,” “Comus,” “Mallard,” “Albatross,” “British Empire” (“Hecla”), or “Snake,” each have features to recommend them, and special uses. But we must maintain ample carrying power for bread stuffs, and other food supplies, also for raw material to keep our factories going. No more risk of dear food, or of cotton famines, can be endured. We must not think of permitting our supremacy to slip from us, nor should we drift into a state of false security, from which we may have a rude awakening. We may have to make sacrifices, but we must not risk such disaster as befell the United States within our own time, irretrievable as it has been. Our Mercantile Marine, instead of being a source of weakness, can be made a source of infinite strength, by preparation, and by due precaution, nor is much money needed; as Captain Harris so clearly stated, in the opening of his paper, the value of our mercantile supremacy, and pointed out how transient history has shown such to be, let us arouse ourselves “every man jack of us,” at home and abroad, so that history may not be repeated, and we may still maintain the British flag as sovereign of the seas.

Captain NOEL, R.N.: Captain Harris has completely cut the ground from under our feet, for he has provided an answer to well nigh every consideration, and I must say, in all his points except one or two, I most fully concur. The paper is a most admirable and valuable one, and we have all to thank him for bringing the matter so thoroughly before us. It was also very well timed, because Mr. Barnaby, in his paper on Battle-ships, sought an answer of this kind, and I think, on all points, Captain Harris has given very fair and proper answers. With reference to heavy guns, I do not quite agree with the lecturer. Heavy guns are intended for use against armour; but recently armour, or at any rate broadside armour, is being done away with, and therefore I do not see that heavy guns are so important now as they were when we had to oppose armoured vessels. Captain Harris says light guns and slow ships will soon be obsolete, and fast ships and heavy guns have a much longer life and usefulness; of course, slow ships become obsolete because the world is going quicker than it has ever done before. We must all go quicker, so naturally we want increased speed in our ships; but I dispute entirely that light guns are obsolete. If we take the lightest guns of all—the machine guns—they are not obsolete. They represent the gun of the future, unless there is armour or some substance to oppose their fire; then, again, the heaviest guns of all require a perfectly firm and steady platform, and that is what we have not got. The heaviest guns are suitable only for forts. What we want at sea is not to pin our faith to one gun, which must be on a perfectly steady platform, but to have several guns, and the less armour there is to protect the guns, the more necessary is it that we should have a number of them. If we have only one unprotected gun to fight, it may be knocked over or disabled, and then there is an end of your gunnery. I have always advocated—and I see no reason for altering my opinion—that we should have a moderate number of moderate-sized guns. The most important part of this paper is that with reference to the Mercantile Marine, and I quite agree with Captain Harris that it will be a very great source of weakness to us in warfare. It is very necessary that the carrying trade should remain in English bottoms, and it is very questionable whether, unless we can afford a sufficient protection for our

Mercantile Marine—that is, unless we can prevent the enemy from using force against it to any great extent—our carrying trade will not, in all probability, go out of our hands. As regards the assistance that the Mercantile Marine can give us in warlike measures, there are very many things against their ships being so employed. As one gentleman tells us, we cannot take their men from them, and another, we cannot take from them the trading duties they have to perform; the country requires food, and therefore we cannot employ the vessels required to bring the food, for warlike purposes. Again, what can a merchant vessel do? If she is armed she must be under our flag, in order to use those arms (I do not think that a merchant vessel armed, unless she is under the Government, can use any force—she would be treated as a privateer if she did—she must be under the flag). All the use that that vessel can be put to is to convoy other vessels of her own class, and to oppose armed merchant vessels of foreign nations. As to a merchant vessel ever being able to hold her own with a man-of-war it is out of the question, so that the only employment for these magnificent vessels in war time is to protect other vessels, that our men-of-war are not fast enough to convoy. The commencement of Captain Harris's paper I more fully agreed with than with the two concluding sentences, which, I think, are rather in opposition to the first part. He expresses in them very great confidence. Everything in this paper tends to show that we require a greater naval force; our force is not so satisfactory as I am certain most naval Officers think it should be. We want vessels, and we want more money. We have a great deal to thank Captain Harris for, in the opinions he has expressed and the information he has given us in this very able paper.

General Sir LINTORN SIMMONS: It seems presumptuous on my part, as a soldier, to raise my voice in this assembly on a naval question, but after the observations which fell from the gallant Admiral just now, in which he drew your attention, Sir, as a Lord of the Admiralty, to the importance of docks, I should like, as an engineer Officer, having been lately employed in the consideration of questions connected with the defence of British possessions and commerce abroad, to draw attention to another very important point, namely, the protection of docks and coaling stations. These will be of no use whatever in war if they have to depend for their protection upon ships and floating batteries, which will find their sphere of action on the high seas; unless, therefore, docks are protected by works of defence, they cannot be relied upon by our ships, which, as the gallant Admiral justly pointed out, must depend in very great measure upon them for their speed. There is another point to which the gallant Officer has alluded, and that is the question of convoys. I have heard this question discussed, and it seems exceedingly doubtful to my mind whether the days of convoys are not past. The steamers in which British commerce is conveyed are, a vast number of them, of very low speed. How, then, are convoys of such ships to be protected in their course from any given port in which they may be collected to their port of destination? It is the speed of the slowest ship in any convoy which must regulate the speed of the whole. If these vessels have only 8 or 9 knots—and a very large number of our Mercantile Marine have only that speed—it will become an exceedingly difficult matter, if not almost impossible, to convoy with safety a fleet of such ships where they are exposed to attack by ships of high speed, that might act against them from any quarter. It is no longer a question of seamanship, and of keeping to windward; but the power of moving by steam in any direction at high speed permits of an attack being made on a convoy from any point of the compass. The question of convoy is, I think, very serious, and it is one which I should like very much to hear debated in an assembly of naval Officers. Then, again, there is another point. The larger and swifter merchant ships are of great use in our carrying trade, and no doubt, in the event of war, a very large proportion of our trade will depend upon the safety with which these ships might make their voyages. In order that they may make their voyages with safety there are two requisites absolutely necessary—a safe port from which they may depart, and a secure port to which they can run. Therefore, unless secure ports are provided at certain important centres of trade with which our commerce is connected, the passage of these ships might become uncertain; so that not only for the purpose of protecting docks and coal depôts, but also in the interests of commerce, it is absolutely necessary that there should be good and secure ports in our Colonies in which

mercantile ships may at all times find refuge. There is another point which struck me as of considerable importance, which has been referred to by the writer—whose paper is an exceedingly interesting one, full of very valuable information, and containing a great many suggestions, calculated to cause reflection, and to elicit very useful results. The writer says: "It seems more than probable that if, in the immediate future, any fleet battles have to be fought, they will be contested on the old historical naval battle-fields—either in our Channel, the Mediterranean, or in the waters of the West Coast of Europe." I believe that will be the case, but I also believe that we shall incur very serious danger on the outbreak of war similar to that with which we were threatened when there was a probability of war some four or five years ago with Russia. On that occasion a small Russian squadron was collected in a port of the United States, in the full anticipation that war would be declared. Now, I think that, in ticklish times, when there is a probability of war, it will be quite within the competence of a naval Power to follow the example of Russia, and to assemble a squadron—perhaps not a very large one, but a squadron, or even squadrons—in different distant ports, which on the outbreak of war would be most embarrassing to our possessions abroad, and to our commerce. The difficulty would be to know where the enemy was, in what part of the world his ships might be lying, and against what particular point or points of our widespread dominions he may direct his attacks. By the aid of steam he may direct his attack against any port or line of ocean trade he might select, and it would be almost impossible to foresee and provide against such attacks. Under such circumstances it is conceivable that small squadrons may, possibly, at the outbreak of war, visit any of our Colonial ports, including some of those valuable stations which the Admiralty consider so necessary for coaling and re-fitting, and as docking stations for cleaning ships' bottoms. This possible and not improbable course of action requires careful consideration, and considering the scattered nature of our possessions, and the vast extent of our commerce, as shown by the diagrams on the wall, entails upon us the necessity of having a much more numerous and powerful fleet than that of any other nation. If time permits, I should like to make one or two observations on the subject of the use to which fast merchant ships can be applied in war. I had not the advantage of hearing Mr. Barnaby's paper, but having giving much consideration to the subject, I venture to think it is a mistake to send out guns for these ships to distant ports with the idea that, on the outbreak of war, they may receive their armament in those ports. If these ships are to be effective on the outbreak of a war, they must be armed in some other way. They can never, of course, be expected to meet and fight the fighting ships of other nations, but they should be fully equal to contend with similar ships fitted out by other nations. Being very fast, they will form a very important element in naval warfare; if they can remain on the routes by which they ordinarily traverse the ocean they will be continually bringing to our naval authorities information of what is going on along those routes, and of the movements of the enemy, which will be of especial value at the commencement of a war; we shall also have to depend upon them for the conveyance of mails to and from the Colonies, India, China, &c., and of some of the most valuable articles of commerce. For instance, the gold trade from Australia, and the food, without which we should be starved into submission in a few months, will have to be carried in these ships; I think, therefore, it would be of the greatest possible advantage if during peace we could organize a system by which these ships might have on board, at all times, the means, in the event of war, of protecting themselves. If, when war breaks out, a ship of that class were at a distant station, Hong Kong for instance, the guns may be there, but if the crew are not trained and the ship not fitted, the Admiral at the station would probably not be able to spare gunners and trained seamen; and the probability is that the ship would be very little better than useless for a considerable time, unless some of its crew had been previously trained to the service of guns. I believe a great step might be taken towards making these fast ships immediately of use on the outbreak of war by adopting somewhat of our Volunteer system; if the owners were encouraged, they might be induced to allow a gun or two of light calibre to be placed, one at the bow perhaps, and the other in the stern, and to have their crews trained to serve them. For this purpose they would require one or two

trained gunners from the navy on board each ship, in the same way as the army give trained instructors to the Volunteer Corps. If the Admiralty supplied trained instructors, men belonging to their crews could be taught to work the guns; not many men would be required, and I venture to think that the knowledge by the public that ships were certified by the Admiralty, and had guns on board, would be an inducement to people to give them a preference as passenger ships and for trade purposes. Inspection, from time to time, would insure that the guns and stores were kept in proper condition, and that the men were properly trained. I venture to throw out these suggestions, having had the subject a good deal under consideration of late, and shall be glad if they may be found useful.

Captain T. BRAND, R.N.: I gather from the last speaker that he, to a certain extent, challenged naval Officers to explain what they want done during war in the way of conveying our merchant navy. I am only throwing out a suggestion, which I hope will give rise to a discussion on the subject, but I think that now the trade, whether it be to the Mediterranean or to America, is always done by steam, and, therefore, that the ships go on a certain line which is known. And I would, like Captain Noel, ask for something—that is to say, that our navy would require a great many fast cruisers, which should be at certain distances apart on those lines, communicating one to another, from time to time, if possible, and protecting the line on which ships travel, and therefore obviating the necessity for a convoy; because, although a ship would, of course, have to take her chance, the enemy's ships would, at the same time, know that, on that line, they were liable to be attacked. With regard to fast steamers, I think those very fast steamers cannot be exactly termed men-of-war, and though they must carry the flag to defend themselves, I should look to them more to combine two things. We are told that they are necessary for our trade, to provide us with food. If they are armed they have more chance of bringing food to the country than if not, and I would say that those fast ships would be a match for, at all events, several of the ships that were commissioned by Russia at the time that war appeared imminent between Russia and England, and I think not only that they might be armed very nearly as well, but also they would probably be faster. Under those circumstances the ships would be used as merchant steamers, carrying the flag and carrying guns, but they would not fight if they could avoid it. I simply throw these out as suggestions.

Captain T. S. JACKSON, R.N.: I, in common with others, have very little to find fault with in Captain Harris's paper. I am rather interested in the distinction which he draws between ironclad ships of a greater speed than 12 knots and those of less speed. I hardly think we should have much difficulty in our Service in dividing those that have a sea-going speed of over 12 knots and those under. Then we come to the question of ocean cruisers. The great difficulty, of course, in getting satisfactory ocean cruisers—men-of-war I mean—so that they may be capable of carrying on an action with men-of-war of other nations, is the enormous size they run to, and the consequent expense. I fancy—I am speaking, of course, very roughly—that it would be hardly possible to produce a satisfactory ocean cruiser, carrying coal supply sufficient to take her over the world, and with good speed, under 9,000 tons displacement. In our fast armed merchant steamers we, of course, sacrifice protection from torpedoes to a very great extent; they are much more liable to injury than the regularly built man-of-war; but we get the speed; we get the coal supply, and we get a certain fair armament; and perhaps the great increase in the value of guns will make these ships very formidable indeed, and capable, not only of protecting themselves, but of protecting others against small men-of-war, and vessels of the same description belonging to an enemy. In the last paragraph, referring to gunboats and dispatch vessels, Captain Harris says, "The function of the gunboat proper, in the ordinary sense of the term, is, during times of peace, to economically represent the national flag in foreign parts, up rivers, and shallow harbours." Now I object strongly to the expression "economically." I believe they are the cause of great expense to this country, and the money swallowed up in a number of little ships, especially on some foreign stations, that can neither fight nor run away, incapable of carrying coal, with poor armaments and no speed—in fact, having no good quality about them but their light draught of water, would give us a few efficient cruisers which, acting in squadrons, would have

a much greater weight. Captain Noel is strongly in favour of light guns, and says that armour is done away with, and, therefore, we do not want heavy guns because light guns are quite sufficient in the absence of vertical armour; but if we give up carrying the heaviest possible guns, of course the vertical armour at once assumes its former value, and then you have to go back again to the heavy guns.

Admiral SELWYN: I desire to commence my remarks by insisting on the view that has always been taken in this Institution that England cannot give up the supremacy of the sea. Whether it is to be retained at a great cost or a little cost, the supremacy of the sea is absolutely necessary to this country, and must be preserved. The next question is how this can be done in the most economical manner. It is, as in most other matters of business, a question of steadily keeping pace with the necessities of the age. We must cease to regret the time when our income and expenditure were not as great as now; we must increase our navy so as to preserve, at all times, the same proportion to our national income as formerly, or you will never get on a right basis of calculation, what expenditure is reasonable for such a purpose; and no House of Commons will ever grudge the expenditure if it is shown to be an absolute necessity of our existence. It is lamentably true that even with the very best proportion we can make there is the unavoidable concomitant of war, called war insurance; and if we were attacked with the facility which steam has given to all nations, there is very little doubt the rate of war insurance would go up considerably above that of other nations who were neutrals, and we should find ourselves handicapped by that burden. We could never afford to entertain the idea of bringing down the speed of a convoy to that of the lowest speed in the convoyed fleet, for if that were done it would at once cut out the whole of the profits of our carrying trade, and the facilities of our passenger and mail traffic, and hand them over to some other nation. It is quite clear that such a carrying trade would involve a loss, in face of the active competition to which it would be subjected. With regard to docks, of which Admiral Jones spoke so strongly, I recognize their value as much as he does. I have long done so, and at the Naval Architects some years ago there was a very pregnant discussion on the subject. They all agreed that to build docks whose length was a constant quantity in any of the Colonies, or in any place, with the view of docking our naval ships, would be a gross error, and for this reason, that we are constantly changing the dimensions of those ships, and that the dock might, in the event of war, be found to require enlargement, which there would be no time to give them. Therefore, I am fully of opinion that the proper provision to be made is the best type of floating dock, whatever that may be; it will answer better, and do more active work at all times, besides being capable of removal from a port, if, unfortunately, that port fell into the enemy's hands. Now I want to give a little consolation to Captain Harris. He has had a great deal of matter that was not in his paper to listen to, under the name of discussion of that paper, and he has not had much help towards the solution of the questions which he proposed to himself and to us. I am happy to say that I know, at this moment, a vessel of 800 I.H.P., which will be launched within the next fortnight, which, first of all, instead of consuming 2.2 lbs. of coal per indicated horse-power, will find 1 lb. of coal amply sufficient; secondly, that the weight of the engines and boilers which do that is far under 100 lbs. per indicated horse-power, instead of being over 300 lbs., which is the best type we have at present; thirdly, that those boilers, once put on board a ship, can be repaired to any extent by the ship herself, and, as far as I know, with fifteen years' experience, they are entirely indestructible,—they do not show any signs of wear after fifteen years' work; and I believe that they will be rapidly brought to the front. I need scarcely point out that that involves the whole question of coaling, the whole question of the time you can remain at sea, the whole question of repairing your engines and boilers abroad, and, in fact, the whole question of the speed and the efficiency of our war-ships. That, I think, must be recognized as an enormous step in progress, and I only regret there is not quite so much disposition as I should wish on the part of those whose business it is to investigate and ascertain that progress, for the condition on which we can retain that supremacy to which I have referred, and which is absolutely indispensable to our national existence, is that we should always be in the van of progress. We cannot hope that others will not imitate it, but we must

not only be able to say that nobody else, in naval affairs, has got anything better than we have, but we must always be able to boast that we have got something better than anybody else. From America I have received information with regard to the subject of using liquid fuel. They are now running a locomotive in America with comparatively little fuel of any sort or kind, and for that comparatively little they are bold enough to use naphtha. The result is this, that, chemically speaking, hydrogen is by far the most valuable constituent of fuel. Many persons have tried to burn so-called water-gas, but they have failed to do it, because the proper conditions were absent; but the Americans, by joining the use of liquid hydro-carbon to the hydrogen, or water-gas, have been able to drive a locomotive, so as to do quite double the duty that any locomotive of its character ever did before—that is to say, it will take a number of cars up an incline which no engine of less than double the weight could have done under any other circumstances. With the boilers and engines for marine purposes I just now referred to, if fired with liquid fuel, there is no destruction of the tubes or flues, no smoke, no dust, none of that noisy rush of steam, due to escape or exhaust, since there is no exhaust or steam escape required, and there is no waste of steam in the engine, because the steam passes back to the condenser, either from the engine or the safety-valve. I can guarantee that I have seen 27 lbs. of water evaporated with every pound of fuel. The fuel was blown in with the steam, but that fuel is not of a character which need give any concern to anybody, seeing that you cannot burn it unless you blow it in with steam. It will burn if it is heated up purposely, and then a wick is used, but not under any other condition. It will give you at least three times the value of the 1 lb. of coal to which I adverted, in respect of producing so much indicated horse-power per hour. First, we reduce consumption to 1 lb. of coal per indicated horse-power; this doubles the quantity formerly carried, and brings us to eight days instead of four. Next we evaporate with liquid fuel 27 lbs. water, instead of seven or eight, and this is far within the truth. Now we have got to thirty days' full steaming by putting in these engines and boilers, of which I spoke, and by having recourse to that fuel. We can take any one of the ships that is below 12 knots if she be not more than 2 knots below, and bring her up to 14. That is, of course, by changing the engines and boilers, by carefully observing the progress of economy in fuel, and by going on, as I desire to see the country go on, with every advance of scientific knowledge. With regard to the employment of the Mercantile Marine as war-ships, we all recollect the time when the East India Company armed their ships. They very wisely and properly did not forget that the chief *raison d'être* of a Mercantile Marine is to carry the commerce of the country; they avoided battle whenever they could; they behaved most gallantly when they were forced into it; and in that way an armed Mercantile Marine may be still extremely valuable. The altered conditions have favoured our commercial marine by giving them greater speed and more manœuvring power, with independence of winds and currents; and they can, to a certain extent, by speed and torpedoes, defend themselves against the most formidable vessels. But those formidable vessels, in other countries, do not exist in such large numbers as in our own, and we ought to be able to keep a certain number of such formidable vessels communicating with each other along the lines of traffic, which are now much more closely defined than formerly. But that, again, is a condition of things that can only be secured by carrying many days' fuel for high speed, and in order to do that the very first condition to be observed is to economize your fuel to the lowest point possible, to make sure of efficient boilers and engines, at all times for long periods, and that you can always get a full supply of the fuel you require. With these few remarks I will congratulate the naval members of this Institution on having listened to such a very effective paper on such an important subject.

Major-General DUNNE: Having been in Egypt during this last winter, I used continually to hear great disappointment expressed among the people visiting there at the want of accuracy of the naval guns, with regard to the bombardment of the forts of Alexandria, as exemplified in the very small number of guns that were knocked over by our fleet; and if, as Captain Noel says, it is impossible to secure more accuracy in naval guns at sea, it does seem very much better to have a larger number of guns than to have to rely on one or two; whereas on shore at the new

battery at Delamira Bay, Malta, where I saw practising three weeks ago, after a third shot at 2,500 yards, a flagstaff was knocked over by a 35-ton gun. If naval guns cannot be depended upon in that way, it seems, when convoying, the greater the number of guns, the more likely you are to keep your enemy at a distance, and when you have to rely only upon one or two guns, you may very often have to let him come to very close quarters.

Lieutenant SLEEMAN, late R.N. : I have heard a good deal said in this Institution with reference to convoy-defence for our Mercantile Marine, but I have never heard it suggested that the question resolves itself into whom is it necessary to defend our Mercantile Marine against? For instance, in the late Egyptian campaign our Mercantile Marine required no protection, for our enemy had no navy. Then if it should be our misfortune to be at war with Russia the whole of our navy would easily hold in check the whole of the Russian navy, and our Mercantile Marine would in that case traverse the ocean as comfortably as they do at present; and if we were at war with Italy the same thing would happen. If, on the other hand, we were at war say with the whole world, then we should have to defend our Mercantile Marine in every part of the world at the same moment that we were also bombarding the ports and holding the other navies of the world in check; and that is why, in order to ensure protection to our commerce, our navy should compare numerically with the navies of other Powers. In regard to the question of big ships and little ships, I often hear it stated that a big ship would be very quickly put *hors de combat* by a number of small ships; but the question of the state of the sea is always left out. I think it would be extremely difficult in ordinary weather for small torpedo vessels or gun vessels to get near a big ship, whose platform would be perfectly steady and which possessed great speed and manœuvring power. Under these conditions that question of the sea seems to me to be entirely left out. The three features of a perfect sea-going man-of-war are steadiness of platform, great speed, and great manœuvring powers; and I think it is almost impossible to combine the three in any ordinary sized ironclad. It has never yet been done. My experience has been that a very slight swell upsets the accuracy of the guns of most ships very soon. The lecturer mentioned a torpedo vessel towed astern of the vessel. Now I am a great believer in torpedoes, and I believe in future naval wars the torpedo will play an infinitely more important part than is accredited to it at present; but I doubt very much if a torpedo with 50 or 100 lbs. of dynamite towing astern of a ship would be at all a pleasant neighbour; it would be more likely to damage your own ship in an ocean fleet-action than do any harm to the enemy.

Captain HARRIS: I was speaking of a single action only.

Lieutenant SLEEMAN: In a single action it might be used; but then if you were brought suddenly to a stop, the torpedo would come rushing up under your stern, which might be rather awkward. I must thank Captain Harris for his very valuable paper.

General SCHOMBERG, R.M.A. : I should like to say a few words on this subject, from an artilleryman's point of view. I quite endorse the paragraph of Captain Harris's which has been attacked, in which he says that "Fast ships and heavy guns have a much longer life of usefulness." I am of his opinion, that it is much better to trust to armament than to armour. I will also repeat that our chief defence must lie in our power of offence. At the very commencement of a naval war we must attack our enemy's strongholds on the sea-board. The best way of attacking such places would be by vertical fire, now called "high angle" fire, from mortar boats, which seems now to be entirely overlooked and neglected.

General Sir LINTORN SIMMONS: There is one remark I should like to make with respect to the question of convoys. I perfectly understand that a given route can be protected by ships along its line: that is not what is commonly understood by convoy; but I doubt very much whether that same system would be applicable to all our great trade routes. A trade route such as that from Liverpool to New York may be so protected, but the protection of long trade routes, such as that to Australia, round the Cape to India, is quite another thing. I should like to hear the question of protection fairly settled with reference to what is ordinarily understood as a convoy.

Captain HARRIS: I am sure I am very much obliged to everybody here present for the kind attention they have given to my paper. And I am also extremely well satisfied that it has elicited so many valuable remarks from different people. I thought that Mr. Barnaby's paper was not replied to as fully and freely as it might have been on the occasion of its delivery, and I venture to think that we have now given a fuller and more complete answer to his questions: I have not time to reply to all the remarks that have been made, but there are one or two observations which I do not like to leave unanswered. Admiral Ommanney remarks that I limit a fleet to 12 knots' speed. I did so because at present it is impossible to get more; I entirely agree with him that if we could get 14 knots it would be far better. Captain Noel, in referring to the fifth question of Mr. Barnaby about guns, says that he differs from me there. I may say, that although he says he differs, yet that I agree with him; for while I firmly advocate the introduction of large guns, still I quite admit the value of small guns used in conjunction with the large guns, and also machine guns; but when he rather pitches into me about my having a little too much confidence in my last two remarks, then I do not think he has read them as carefully as he might have done, or he would have seen that I mention—perhaps it may be qualification on my part—"that if we are true to ourselves"—if we are true to ourselves we certainly shall never allow our fleets to go to the bad; we, as the leading maritime Power, ought to be always strong enough to meet a combination of any two or three other Powers; and in that case I do not think it can be said that I am over-confident in my concluding remarks. No doubt, as Sir Lintorn Simmons remarks, the whole question of convoy is most important, and demands our serious attention; it would be well worthy of a separate paper, and I cannot attempt to reply to it now. I should, however, hope in the event of war that we should be able, in a very short time, to assume such complete control of the seas that convoys would be needless. If we could once blockade an enemy's ports, we ought never to allow a vessel to escape from them, or at any rate be long at large from them, and in such a case our carrying trade would soon return to its normal condition. I may again say that I am much obliged to you for the attention you have given me, and repeat that I am well pleased to have been the means of affording a more complete answer to and discussion of Mr. Barnaby's important paper, than was obtained on the occasion of its being read.

The CHAIRMAN: In the position of responsibility in which I am placed with reference to naval affairs, a position which I am quite unworthy to fill, I should doubtless exercise a wise discretion if I were to confine myself to offering my compliments to Captain Harris for the able paper which he has read to us. But I feel so deeply interested in the paper that I should like to offer a few remarks. In the opening passages of his paper, Captain Harris refers to the communications with our Colonies. We are not insensible of the gravity of the questions. At the same time we may note with satisfaction that there is an increasing capability on the part of the Colonies to provide for their own defence, and to co-operate with the mother country in carrying out the Imperial policy of the British Empire. With reference to the Mercantile Marine, we cannot conceal from ourselves that it is at once a source of strength and a source of weakness. With existing estimates, or with any increment of expense which we can reasonably entertain, it is impossible to provide or to create a pure fighting navy, proportionate to the difference in the tonnage which is afloat under the British flag, and which is afloat under the flags of other Powers. On the other hand, this great Mercantile Marine implies that we possess all those essential and vital elements of naval greatness to which Captain Harris very properly referred, implies the power of extension and of creation in a degree to which no other maritime Power can possibly pretend to have attained. The lecturer has referred to two points which involve great difficulty in regard to the naval administration of this country; he has referred to the financial difficulty. It is very difficult to be precise in defining what is the amount of expenditure which would be sufficient to maintain an adequate navy for this country. All that we can say at the present time is this, that we have made a considerable increase in very recent years in the expenditure upon the material of the fleet. The increase of expenditure in the last three years has been not less than 400,000*l.* in the ship-building votes. What the future requirements of the country may demand is, of

course, a question of policy, on which it would be most unwise and imprudent on my part to express an opinion on this occasion. I can only say that we are watching with vigilance the proceedings elsewhere. The lecturer very properly referred to the difficulty of determining the application of the expenditure, whatever this amount may be, which may be placed by Parliament at the disposal of the naval administration. The lecturer, to whom it was said that little consolation had been offered in the various speeches, will derive a substantial consolation, if he needs it, from his observation of the policy which has been lately pursued in the construction of the fleet. The general lines which he indicated have been tolerably closely followed in the recent application of the ship-building votes. The lecturer insisted, in the first place, upon armoured plating as the prime necessity for the navy, and he spoke of a speed of 12 knots as being an essential condition; but he was silent in reference to the thickness of armour, and the weight of armament upon which he would insist. I can only say that these points on which he was silent are very important and essential points. If we were content to build the smallest vessels which would satisfy certain conditions with reference to armour and to armament, it is obvious that we might increase our numbers much more rapidly than we are now increasing them. I have always been an advocate of reasonable limitations in regard to the dimensions of our ironclads; but we cannot conceal from ourselves this fact, that for every addition which is made to the tonnage, the naval architects can make some valuable addition to the fighting efficiency of our ships. They can increase the armour, they can give greater speed, they can give greater coal endurance. On the other hand, as you increase the tonnage, so you tend to diminish that facility of movement which is of supreme importance in the use of the ram, and you also involve yourselves, probably, in difficulties with regard to the draught of water. Having these considerations in our view, it may be claimed for the recent policy of construction that we have avoided extreme dimensions. We have endeavoured to meet the point raised by Captain Noel, with reference to light guns, by giving to the new type of ships, the so-called "Admiral" type, a mixed armament which includes, in addition to the heavy guns, what I hope will be a very valuable battery of light guns. With reference to speed, the lecturer asks for 12 knots as a minimum. I am glad to know that we have gone far beyond the minimum laid down by the lecturer in the recent development of our armour construction. We hope to obtain in the vessels of the "Admiral" type at least a speed of 16 knots, which represents a very great advance upon what has hitherto been obtained. That advance is due partly to improvements in the means of creating forced draughts, but also to a sensible improvement in the models of our ships. We have given them greater length, and a form which admits of the more ready attainment of the important quality of superiority in speed. The lecturer next insisted upon the essential value of fast corvettes, and he very properly said that suitable vessels for the purpose of defending the commerce of the country could not be improvised; and that, therefore, the construction of those vessels should not be delayed in time of peace. Without expressing an opinion as to whether or no what we are doing now is adequate, I am glad to say that we are doing something to meet the views of the lecturer. It has been the recent policy to replace in the building programme those large corvettes not exceeding 14 knots by a class of vessels of the "Leander" type, which will have a speed of 16 knots, and by a still more recent design, known as the "Mersey" and "Severn" type, which will have a minimum speed of not less than 17 knots. Captain Brand referred to the importance of these fast corvettes with reference to the altered character of our communications by sea with the various foreign emporiums of trade, and he pointed out, and I entirely agree with him, that the task of the navy is made more easy by the transition from sail to steam. He insisted upon this fact, that along the great lines of trade the vessels following very much the same course can be more easily protected than in former days when they were propelled by sail, and necessarily were much more widely scattered over the seas. My gallant friend, Sir Lintorn Simmons, I think, has expressed some doubt as to the ability to provide for the protection of commerce by undertaking to patrol any given route which that commerce might follow, and no doubt the General's objections are perfectly valid with reference to many important portions of our trade. But so far as I may venture to speak as an amateur sailor, my experience

goes far to confirm what fell from Captain Brand. Nothing impressed me so much, when crossing the Indian Ocean some three years ago, as the extraordinary regularity with which we seemed to meet steamers going in the contrary direction to ourselves from Point de Galle to Penang; we met them on the starboard side, we met them on the port side, we were constantly meeting steamers, showing with what extraordinary precision under steam the navigation is conducted along the shortest route from one point to another. If that be so, of course it is much more easy to protect by means of patrol than it would be when the commerce was more scattered. The lecturer referred to merchant vessels as having a valuable function in relation to naval defence. The measure of that value must depend upon the kind of attack which you anticipate in the event of war. If the attack is to be an attack upon your commerce, and made in vessels similar to your own merchant vessels, then much may be done by judicious organization to give to the Mercantile Marine the power of self-defence. As far as we may derive some conclusions from what is taking place abroad, it is important to notice the high appreciation which is expressed by foreign administrators of the fast merchant steamer. We find that appreciation expressed in a practical form of great and increasing subsidies to postal steamers, the construction of which is encouraged, with reference to their double use, both for the purposes of postal communication in time of peace, and also for conversion into auxiliary cruisers in time of war. I would not give the merchant steamer a higher value than this, that it is capable of meeting a similar vessel under foreign flag. Then the lecturer referred to gunboats, and he said he did not ascribe any very important value to gunboats for the purposes of war. I entirely concur in that view. We must always be prepared to create rapidly gunboats for special operations; but I hold that it would be wise in time of peace to be content with building and maintaining a sufficient number of gunboats for the purpose of the police of the seas. The lecturer said the gunboats were not very valuable for the police of the seas, and that they were very expensive for that purpose. There is much truth in this, and I venture to think that we shall find the type of sloop a more valuable vessel for the police of the seas than the smaller class of gunboats. I quite concur in what fell from the lecturer as to the policy of building fast vessels, developments of the idea initiated by Sir William Armstrong. No doubt the type that Sir William Armstrong has produced is not perfectly satisfactory from a naval point of view. Those vessels are fast and powerfully armed, but they are greatly inefficient in accommodation, very miserable to live in, but it is a type to which attention should be directed. With regard to the torpedo vessels, I apprehend it is the general opinion of naval authorities that they may become at some future time the most formidable assailants for our ironclads. I say, therefore, that these fast light vessels, whether gun vessels or torpedo vessels, are vessels which we should be building, in a certain reasonable proportion, in time of peace; but, on the other hand, I fully concur in what fell from Lieutenant Sleeman, that such vessels can never be regarded as substitutes for the larger vessels. You must have the larger vessels as well as the smaller vessels. The large vessels are, as it were, the naval basis from which the smaller vessels may act, and they are absolutely indispensable for the important purpose of holding and keeping the seas, and carrying large bodies of seamen to the various points at which the navy may be called upon to act. We have had the value of large vessels, and their power of carrying large crews, signally illustrated lately. No small vessels, however swift or handy, or powerfully armed, could have been able to render the service in support of the army which was lately rendered by the fleet in the Mediterranean. Sir Lintorn Simmons and other gentlemen have referred to the subject of docks. I can assure those gentlemen that our necessities with regard to docks have not escaped my attention, and I do not consider that the necessity for docks is at all affected by any doubt or uncertainty that we may feel with regard to the future dimensions of our ironclads. If late there has been no tendency to increase the length of our ironclads. At the same time, looking to these matters with reference to the conditions under which public affairs must be administered, I may point out that we are making steady progress with regard to docks. What we are doing at the present time is this: we have undertaken to double the dock accommodation at Malta, which will be a great benefit to the navy. A dock is being completed by a private company, assisted by

the Admiralty, which will be of great service at an important strategical point namely, the Cape of Good Hope. We are in negotiation for another dock at Hong Kong, capable of receiving any ironclads sent to that station, and we are following up a negotiation with the Indian Government, with reference to the dock accommodation at Bombay. I hope that, whether under the present Government or the Government which may follow it, these good intentions may be carried into effect. While acknowledging that we have necessities which have not yet been met, it is of course obvious that we are not worse off, but rather better off, than any Power with which we might be engaged in conflict. I only desire to say, in conclusion, that such papers as that which has been read to us by Captain Harris, and such discussions as that which has followed the reading of the paper, are of immense value. They suggest ideas, they promote thought on these subjects. I am very glad to have been present on this occasion, and I can assure Captain Harris that his paper will be appreciated.

Admiral LUARD: While we all unanimously thank the lecturer for his paper, I think we cannot do less than agree, with equal unanimity, to thank Sir Thomas Brassey for having come here to-day at great inconvenience to himself, and also for having given us the very interesting observations to which we have just listened.

Friday, May 4, 1883.

GENERAL THE RIGHT HONOURABLE LORD WOLSELEY, G.C.B.,
G.C.M.G., &c., Adjutant-General, in the Chair.

THE LATEST DEVELOPMENT OF THE TACTICS OF THE THREE ARMS.

By Colonel C. B. BRACKENBURY, R.A.

BEFORE entering upon the consideration of the late tactical developments, it seems necessary to clear the way by defining the meaning of the word tactics, which is sometimes confounded with strategy on the one hand, and with drill on the other. The whole art of war, whether conducted on the greatest or the smallest scale, is governed by one great principle—namely, to bring a superior force of one's own in contact with an inferior force of the enemy. The superiority may consist in either of two things. Physical superiority as in number, armament, &c., and moral superiority which may be gained in many ways. Military organization and strategy have to deal with the preparation of armies, and the great movements on the theatre of war which bring them into the neighbourhood of the armies of an enemy. At this point the art of tactics asserts itself, and may be defined as the movements of the parts of an army when in close proximity to the enemy. Drill is one of the details of tactics, and enables tactical combinations to be carried out. But drill may be said to be mechanical, while the tendency of tactics is to become less and less mechanical, and to give more and more value to moral considerations. We have nothing to do this afternoon with strategical combinations, only with pure tactics.

There has been of late years a good deal of controversy on tactical subjects. The present system of fighting, adopted with much reluctance by this country, appears at first sight a concession to irregularity; if this were true no theoretical arguments should be permitted to weigh against the great elements of military success, discipline and order. But in truth the modern system is but an effort more or less satisfactory to reintroduce order under conditions of weapons which tend to produce disorder, and I shall attempt to show that the tactics of the day are the natural development of an art which has been progressing gradually in a definite direction during the whole period of European history. A few words on the past may serve to show what its direction has been.

In the Punic wars, when men fought hand to hand in heavy masses, and when cavalry could approach unharmed within 15 yards of infantry, Hannibal obtained his great successes by ambushes, and by

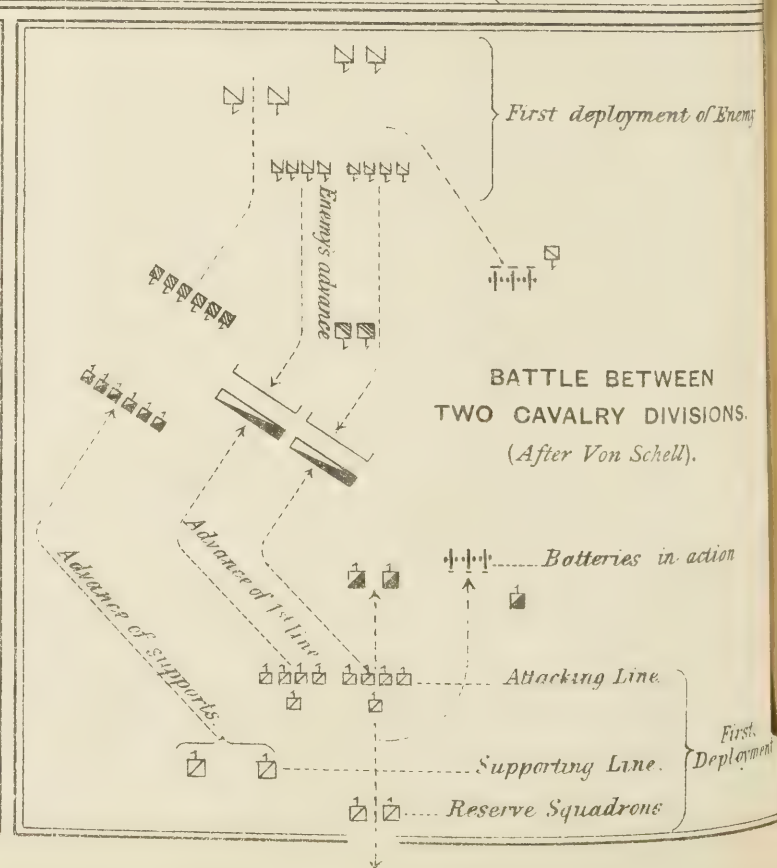
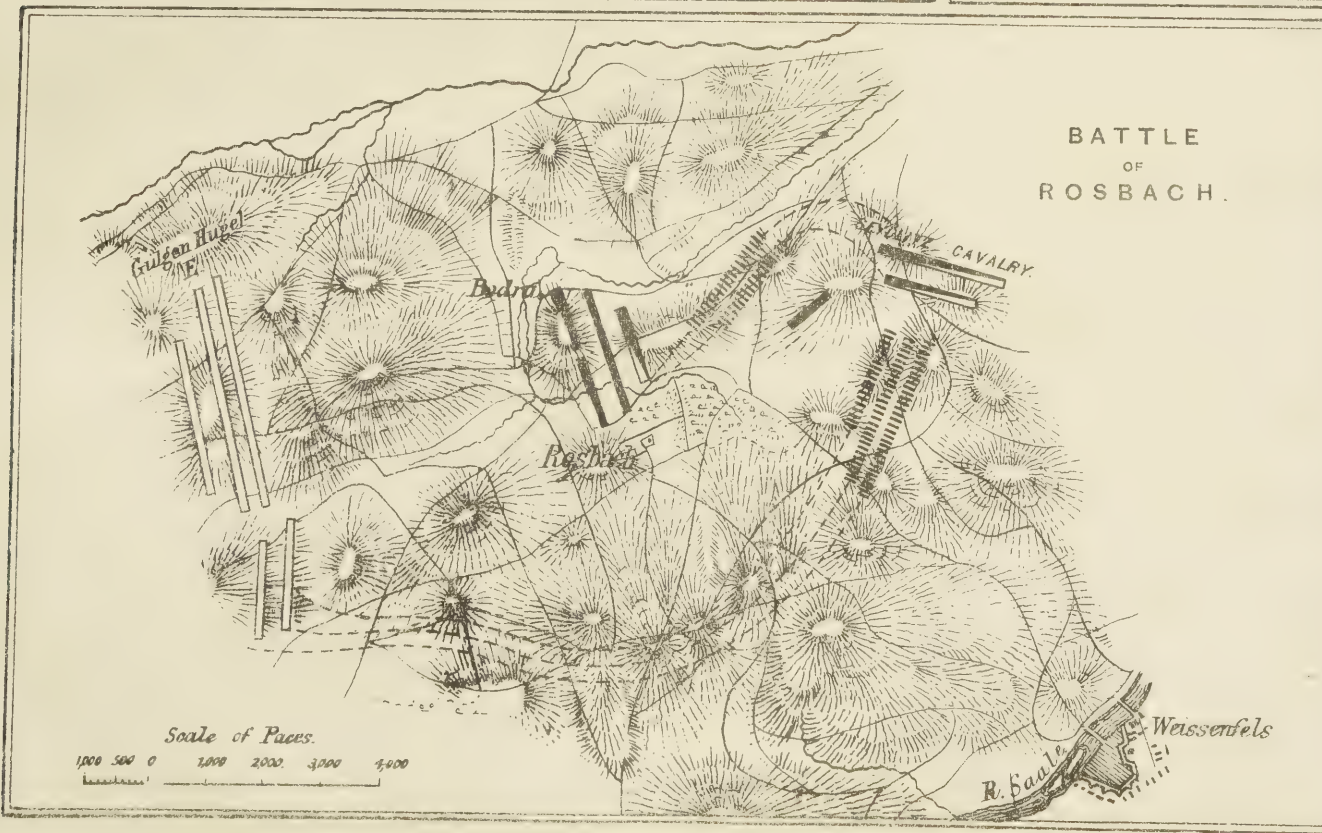
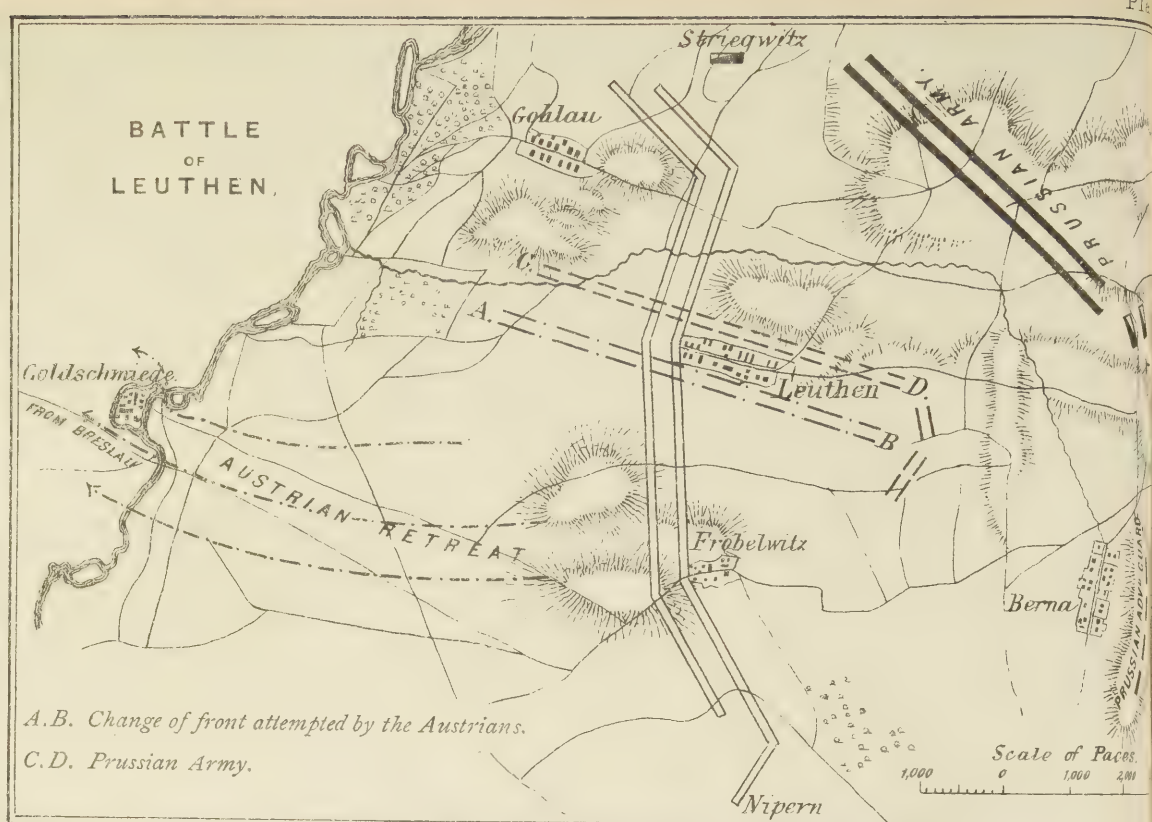
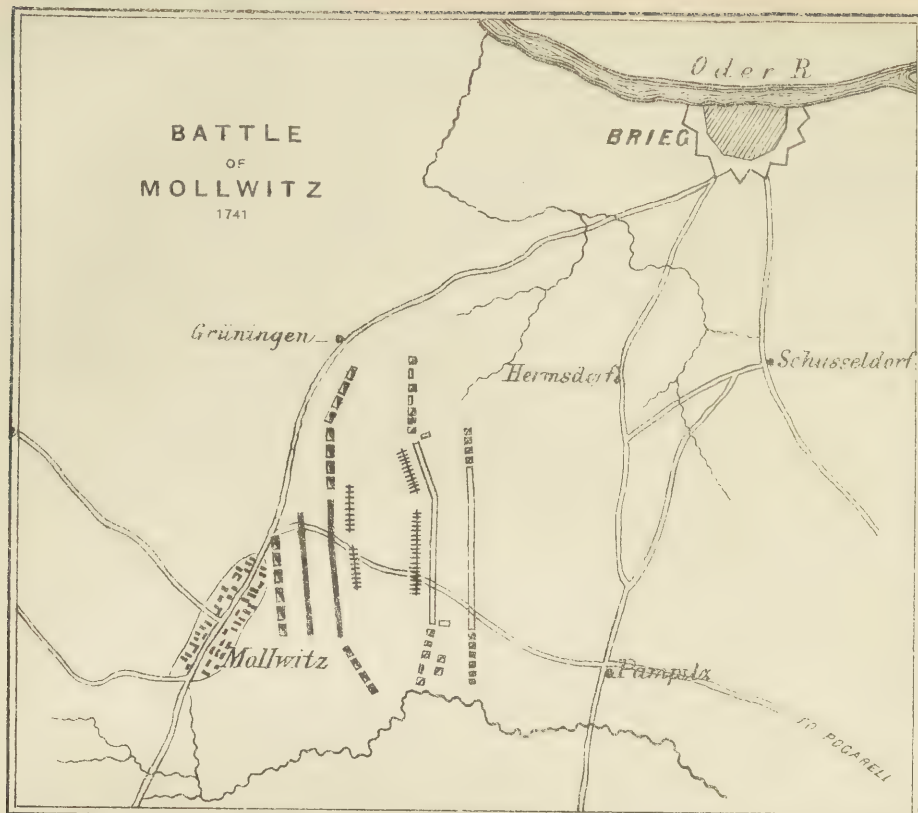
acting on the Roman flank in oblique order, or on both flanks at once. Here were the physical superiority of the flank attack, that is, many men acting against few at a particular point, and the moral effect of surprise.

If we leap over many years and look at Marlborough's campaigns, when armies fought in two lines, each two or three deep, with muskets which carried 200 yards and slowly moving cannons, the effective range of which was perhaps 1,000 yards, we see that armies would commence their struggle at a greater distance apart. Drill had not then made armies flexible, manœuvres were difficult, and the usual course was for one army to take up a position and be attacked by another advancing parallel to it. Marlborough, with the eye of a born General, read the phases of a fight, detected the weak points of an enemy, and concentrated his attack there. For instance, at Ramillies the enemy had posted one wing of his army behind a marsh, it was unattackable, but neither could it attack. Marlborough let it alone, and brought his whole force to bear against the other wing, which was easily beaten. Here again is the physical superiority, telling at the right time and place, and the moral superiority obtained over a force which finds itself hopelessly out-manœuvred.

In the wars of Frederick the Great no great changes had been made in armament. The ranges were still short, the greater part of the artillery was scattered among the battalions—two guns to each battalion—and the introduction of iron ramrods was but a small improvement compared with the late change to breech-loaders. But Frederick's father had so improved the drill and discipline of the Prussian Army that it could manœuvre as an army, though very stiffly, close to and even within sight of the enemy. In his first battle at Molwitz there was no manœuvring, the two armies were in exact parallel order, and of the same strength nearly. The fight was won by the steadiness of the Prussian infantry and their superiority in rapidity of firing. But, as Frederick learned war, we see him adopting the principles of Hannibal with better means for carrying them out. At Leuthen he commanded about 34,000 men, and defeated an Austrian Army 80,000 strong by neglecting its front and centre and concentrating on its left, which he rolled up till it stood demoralized at right angles with the right wing, when the King's artillery enfiladed both wings and his left attacked the Austrian right flank as it attempted to swing round. His advance under cover of low hills against the original left of the Austrians was of the nature of a surprise, and gave him at the decisive point the advantage both physical and moral.

At Rossbach he may be said to have formed an ambush for the combined enemy. He surprised and enveloped the head of their column which was advancing in full belief of success, destroyed it, and rolled up the whole army which was unable to deploy under the fire of his artillery; for by this time he had learnt the value of the massed fire of guns. Thus he obtained the superiority, physical and moral, at the important point, though he had only 22,000 men and his enemies numbered 50,000.

So far we see the same principles carried out by methods differing



BATTLE OF MOLLWITZ 1741



Paces.
0 2,000 3,000



Scale of Paces.

1,000 500 0 2,000 2,000 3,000 4,000

of Enemy.

EN
SIONS.

action

First
Deployment

only as progress in armaments, and in the drills based on the development of weapons differed. An army acted as a great whole only divided into two wings. Great as was the progress in drill there was still much wanting in flexibility, even considering the arms in use. But now came a great change, the offspring of Republican ideas in America and in France. In the words of Decker, "each Republican, feeling himself called upon for the defence of his country, longed to combat personally with his own good arm. The stamp of the real skirmisher was marked in every French soldier by that ardent wish to give all freedom to his natural courage. But when it was a question of force, all united in a dense mass, and disputed the honour of falling in the front rank. Hence arose the system of skirmishing; hence also the masses. They sought the most broken ground, and the combat was often decided by clouds of skirmishers, frequently indeed without any supports." It is interesting to observe that the Republican ideas of the French Revolution produced very nearly the same effects as appeared in our time in the aristocratic Prussian Army during the Franco-German campaign. It was given to Napoleon Bonaparte to organize the new force in his great wars just as all Europe is organizing a similar force now.

Napoleon and his Marshals used these clouds of skirmishers covering and supported by strong columns. The Division containing all three arms had begun to be indicated late in the Seven Years War. It was now definitely organized, and Army Corps were formed out of any number of Divisions according to circumstances. Their commanders had considerable power of initiative, and thus great armies became vastly more flexible. Flanking movements could now be executed by what were practically small armies complete in themselves, or, as was more frequently the habit of Napoleon, a weak part of the line could be broken through, and the rest of the enemy rolled up towards one or both flanks. Napoleon also introduced the offensive action of field artillery, handling masses of guns with extreme boldness. All the armies on the Continent trained on the tactics of Frederick went down before the new manœuvres, which were based on the two principles—flexibility of infantry, and the bold use of artillery for offensive purposes.

But the weapons both of infantry and artillery were only slightly improved, and it was still possible for infantry to remain in formation fully exposed till an enemy came within charging distance. As France gradually exhausted herself by her many wars, the individual value of the soldiers decreased, and there was an abuse of the formation in heavy columns. The steadiness of English infantry, after Wellington had trained it under his own eye, enabled our great General to oppose to the skirmishers of the French a more solid formation than theirs, and to their columns a greater development of fire. Wellington and Napoleon never met until the vigour of the Emperor was waning. And when they did meet at Waterloo, though our troops behaved magnificently, the battle was virtually decided by the attack of the Prussians on the French flank.

Nothing new in tactics was to be learnt from the Crimean War.

The British infantry was much better armed than the Russian, and even if it had not been so, the Russian heavy columns, without clouds of skirmishers, were sure to be beaten by the development of fire from the English line. Only two things are to be observed—that the English line got into confusion whenever it advanced over broken ground, and that the turning points in the two great battles of Alma and Inkermann are marked by the independent use of artillery.

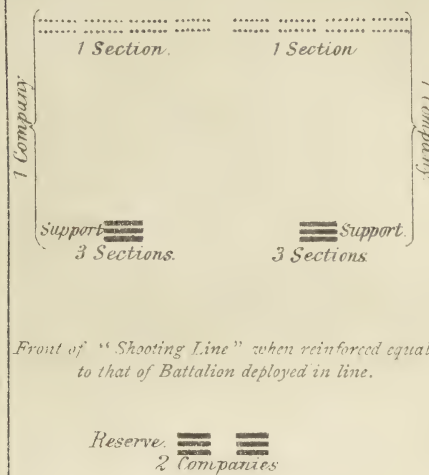
See, then, how we have advanced from the Greek phalanx and the Roman legion, more flexible than the phalanx, omitting the desultory slow wars of the middle ages, through Marlborough's strokes with armies almost immovable on the field of battle, to a time when, under Frederick, small armies were handled close to the enemy with considerable ease, then to the revolutionary clouds of skirmishers and heavy columns, armies being broken up into corps, divisions, and brigades. Field artillery enters into the arena as an offensive arm manœuvring outside the infantry, and creating great effects by acting in masses. It is unnecessary to waste time in giving instances of this. All soldiers know the Napoleonic system, and that there were battles, as for instance Friedland and Hanau, which were distinctly won by the advance of masses of guns to close quarters with the enemy.

We have now arrived at a period when those great changes in weapons began which have since modified profoundly the whole scheme of tactics. First came the infantry rifle with its sudden increase of range, fivefold, from 200 to 1,000 yards. Many a prophecy was made that the days of cavalry and artillery were numbered. Certainly, the relations between the three arms were altered; but ere long rifled artillery was introduced, doubling the effective range of the guns, and since then there have followed breech-loading rifles with range still further developed and improved rifled ordnance. How have these weapons affected modern tactics, and what is the general result as forced upon the minds of tacticians by actual war?

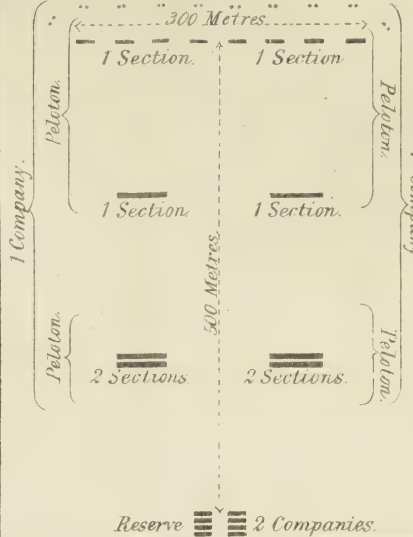
A few months ago it would have been necessary to advocate the claims of the spade to a place in the equipment of infantry. It is now adopted throughout Europe, and the chief point is to practise the men in leaving cover quite as much as in making it.

Let us first speak of the most important arm, and exclude the others. Putting aside special cases to which we shall come presently, the first effect of firearms so greatly improved in range, accuracy, and rapidity, is undoubtedly to delay the final shock which decides the combat, and in many cases to get rid of it altogether, because one side or the other has established its superiority, and so oppressed the spirit of the antagonist that he retires before close quarters are arrived at. It used to be common to reserve infantry fire till the enemy was within 100 or even 50 yards, and over such a short space it is easy to charge; but men cannot charge for 1,000 or even 500 yards, to say nothing of the extreme ranges now sometimes advocated—2,500 or 3,000 yards. There was once a time when the Italians had brought their style of fighting to such a pass that armies manœuvred and manœuvred, each according to the strictest rules, and hardly came to blows at all, or if they did, recognized at once which side was the

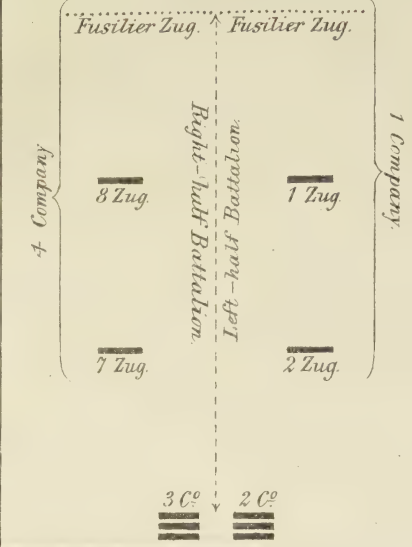
AUSTRIAN BATTALION IN "ATTACK ORDER."



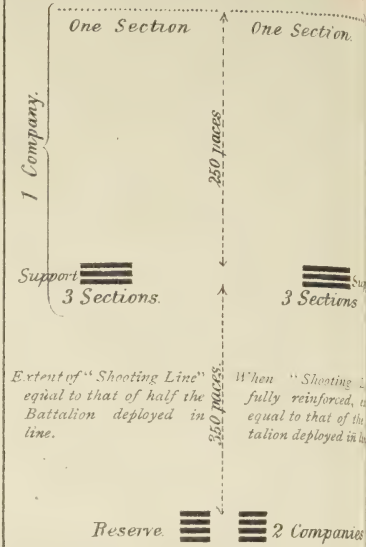
FRENCH BATTALION IN "ATTACK ORDER."



GERMAN BATTALION IN "ATTACK ORDER."



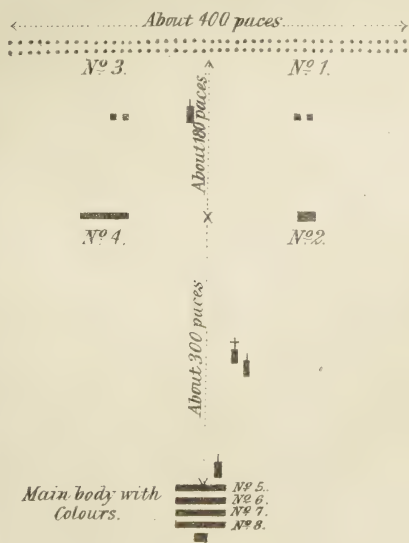
ITALIAN BATTALION IN "ATTACK ORDER."



ENGLISH BATTALION ATTACK.

1ST STAGE.

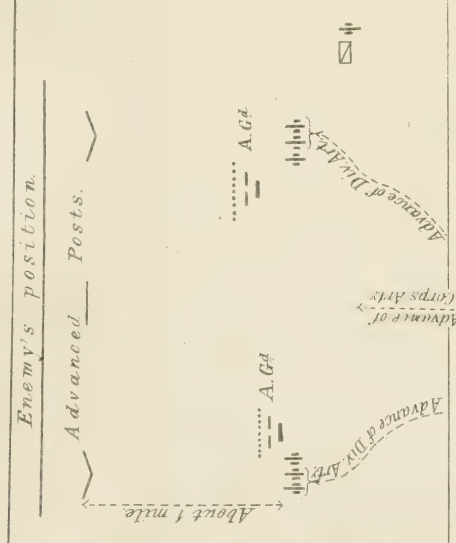
(Say 2,000 yards from Enemy's position.)



ATTACK OF AN ARMY CORPS

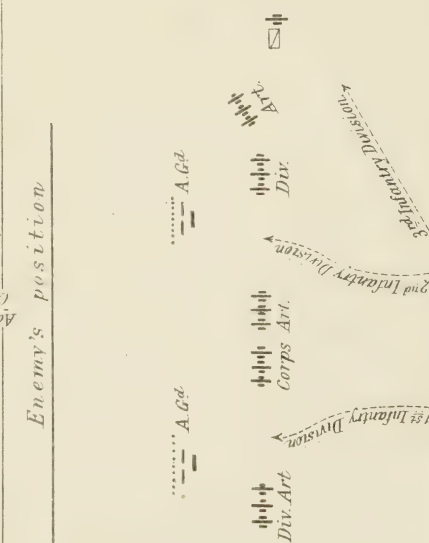
1ST STAGE.

Advanced Guard reinforced by Divisional Artillery driving in the advanced posts.



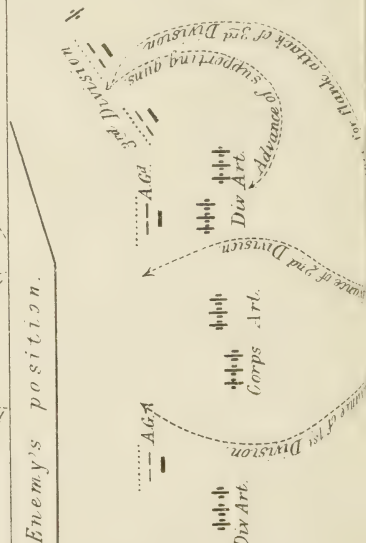
2ND STAGE.

The Artillery Duel. Subsequent Infantry advance.

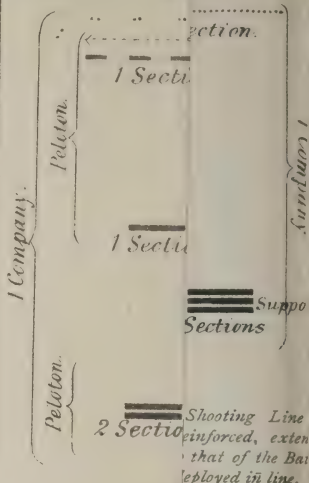




3RD STAGE.

The Enemy's Guns being partially silenced, Infantry advance followed up by the Batteries, a flanking attack commences.



FRENCH BATTALION ORDER."



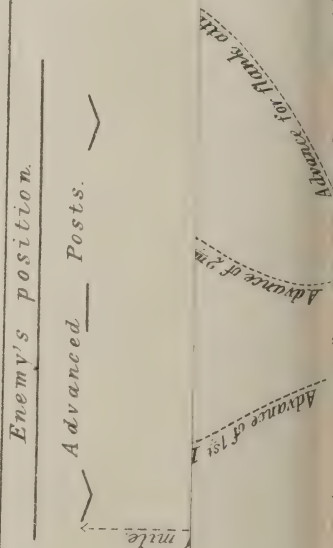
Reserve.  
2 Companies

Reser companies.

1ST STAGE.

(Say 2,000 yards from Enemy's position.)

Advanced Guard rapidly silenced, the
driving the Batteries, and
ances.



stronger, and the weaker retired with losses ridiculously small. But Italy was invaded by troops far less highly trained, only imbued with the idea that the soldier has to get at his enemy and beat him well. The result was not favourable to the Italians of that day. It may be said with some assurance that a similar fate will befall that army which trusts to long-range infantry fire, and seeks to fight in that manner. This is certainly the general belief among the Germans, and they have had pretty good opportunities of forming a sound opinion, based upon practice. Suppose that my arm were long enough and strong enough to throw a stone over the top of St. Paul's, and that I have an enemy up there, I might stand below and pelt him for a month without effect. He would simply get behind the cupola. If I want to beat him thoroughly I must go and seek him there. There may be occasions now and then when specially trained marksmen will be of value at long ranges, but they will never drive away the enemy's troops. Nothing but actual contact or the dread of its imminence will make him run away. There must be either the physical struggle or the moral effect produced by the approach of it. How long did the Russians bombard Plevna without effect? Do you think that the Egyptians would have broken up as they did, if our lads had fought at long range?

Excepting the few cases in which long-range fire may be useful, the general opinion is that the great power of the modern breech-loader, due to the rapidity of its fire and the flat trajectory of the bullet, makes the last 800 or even less, say 500 yards, of advance so extremely hot for the enemy that he arrives, if he arrives at all, cut to pieces by the drift of lead, weakened in numbers, and with all the devil taken out of him. What under such circumstances would happen to the trim lines of Frederick, or the heavy columns of the past? They would be lines and columns no longer, and the men taught to trust to those formations and the familiar touch of a comrade's elbow would have no formation at all, and very likely no comrade. Nor is the jogging together of elbows at all favourable to accurate shooting.

If, then, formation must be destroyed, and shooting is all the better for plenty of room, the infantry soldier must come to an open order style of fighting, and his teachers had better recognize the fact and train him so that he will not be astonished when the moment of trial comes. This necessity is at the bottom of all new tactics for infantry. The open order was not evolved out of the brains of library students; it made itself on the field of battle, when for the first time German troops, then the most stiffly drilled in Europe, faced the French Chassepôts in 1870. But a whole battalion extended in open order would be ridiculously out of hand, and immediately mixed up with other battalions coming up behind to its support. So we come, not by abstruse reasoning, but by the pressure of irresistible facts, to the kind of formation for an infantry advance which is now practically the same throughout Europe. First a chain of men advancing in open order, and covering a front which is about that which would be occupied by the battalion if it were in line, then supports, one for

each wing, then a reserve. By this means the battalion has all the ease of movement of a column with even greater power of seizing advantages of ground for approach under cover; while, by reinforcing the front line from behind as the enemy is approached, the full development of fire possible to a battalion can be obtained, or if the battalion is acting independently, the reserve can be used for a flank attack, or to bring a preponderance of power to any part of the front at a critical moment. There is here nothing strange, and certainly no departure from the regular course of development during hundreds of years. By reason of the modern rapidity of fire, the front line is quite as powerful as the old three-deep shoulder-to-shoulder line of Frederick; each man having the full use of his arms and legs, and, therefore, of his weapon, is strengthened and as it were multiplied while the commander of the battalion keeps, to the last possible moment, control over a reserve which he can throw into the fight when and where he will. He must be a tactician to meet his responsibilities well; but this also comes in the regular order of progress. General education is more widely diffused than of old, nobody can get on without it. Why should military education alone be the province of a select few? Of one thing we may be quite certain, if an Officer who has been long enough in the Service to command a battalion has not acquired the power to handle it with an eye to tactical advantages, he is never likely to be fit for higher command in war. We might as well take a steady church-going solicitor and make him Archbishop of Canterbury.

Only one or two remarks are necessary on the formation of the battalion shown in the diagrams. The Austrians, the French, and the Italians have practically the same. The companies, nominally 250 men strong, are divided into four sections, of which the first leads, and is gradually reinforced by the others, so that there is no mingling of different companies till the reserve comes into play, and not even then if it acts on a flank. There is thus the moral advantage that all the men know and trust each other well, and the *esprit de compagnie* is preserved as long as possible. The German formation is similar, but the company is originally formed in three *zugs*, which have really descended from the old three lines. The third is called the *Fusilier Zug*. These fusiliers used to be the best shots in the battalion, and still occupy the third line until the formation for attack takes place. But the principle is the same in the German Army as in the rest. Shooting line, supports gradually absorbed in the shooting line, and a reserve kept in hand as long as possible. Mixing of companies to be avoided.

The English battalion, as we all know, has eight companies instead of four, and the result is that in our attack formation No. 2 company supports and reinforces No. 1, and No. 4 acts in the same way for No. 3. Here is a clear violation of principle, and the only remedy, short of increasing the size and diminishing the number of companies, would be either to have the first four companies side by side, each company having its own shooting line and supports, or so to bind the companies together in pairs that each pair shall always act

like one company, and, in fact, form one, except in name. As matters stand, we sacrifice the great moral power of accustomed comradeship, and mix different, perhaps rival, companies long before Continental nations mix theirs. I venture to submit that this is a serious matter, and something very like organizing disorder. It is impossible to rate too highly a true *esprit de corps*, extending even down to companies. A good many of us have suffered awkward wrenches to *esprit* of late years, and deserve every sympathy, though the change was for the good of the Service. But, surely, *esprit de corps* does not rest only upon names and facings. If it did there would be something very wrong about the spirit of the Army. The solid foundation must be the belief of every Officer and every man that his comrades there assembled, at that point of time, are noble and trustworthy, capable each one of doing his own duty in his own sphere, and ready to lay down his life if necessary, but, far preferably, to preserve it and that of the rest by well-directed boldness and readiness to help. This kind of *esprit* must begin in the company, and I confess to some feeling against the rapid mingling of different companies in the English attack formation. I have not come here to criticize its many points admitted to be doubtful. It is a great improvement upon the old stiff line, but may, I believe, be characterized as in a state of transition.

I would now invite your attention to some points involving principles. In the first place it is impossible to say, and nations experienced in war do not say, at what distance from the enemy the attack formation must begin, nor the exact distance between the various portions into which the battalion is divided. All must be according to circumstances. You might as well ask a housekeeper what she generally orders for dinner. Battles are now, for the most part, fought on anything rather than smooth plains, and perhaps the reply nearest to the truth would be—the formation begins when the fire of the enemy, or any other cause, obliges the infantry to leave the roads and begin to press forward across country; and the distances from front to rear must depend upon circumstances, the rule being that “behind every extended line there should be a closed body near enough to give timely assistance, but, if possible, not exposed to the same fire.”¹ All Continental nations agree that the shooting line should work by groups, each of which may be extended or contracted according to circumstances. The Austrians, who suffered most from the old evil of rigidity, now, most of all, give freedom to the leaders of groups. It is also agreed that the smallest amount of men possible should be extended in front at first so that the commander of the battalion may retain full direction of the movements as long as possible. For the same reason, and in order to keep as much solidity as may be, one-fourth of the battalion at least is always to be held in reserve to the last moment.

And now, with regard to the method of delivering fire, a point of great importance. Success in war is based upon a clear reading of

¹ “Outline of the Attack Formations for Infantry.” Intelligence Branch, 1881.

the facts of human nature, and among those facts none are more certain than that the tendency of mankind is to yield before audacity and enterprise. These qualities were present in the French system which overthrew the old regularity of Austria and Prussia. By audacity Frederick the Great defended himself for seven years against a world in arms, and issued victorious from the struggle. To attack is to begin with a moral advantage, and this principle is now so fixed in the minds of the Germans that they endeavour to give not only their movements but their fire itself an offensive character. Slow, continuous shooting has not that character, and a rapid fire sustained for a long time would exhaust ammunition. They prefer, therefore, angry outbursts of energetic action, showering many bullets for a short period, with intervals of ominous silence, during which the smoke clears away and ranges are corrected. Evidently, in this way the rifle fire can be kept under perfect control until within short range of the enemy, and it is believed that the spirits of the men will rise and those of the enemy be depressed in proportion, just as an actor creates in himself and his audience the passion which he simulates. Used in this manner magazine rifles may become of the greatest importance in war, and though I believe that the statement of the complete adoption of this arm by the Germans is somewhat premature, they have gone further towards its employment than other nations. If magazine arms are placed in the hands of infantry without some such regulation as this, there will be a great and probably wild expenditure of ammunition. The same idea of quick bursts and pauses of fire now prevails in nearly all armies, only the fashion of carrying it out varies a little.

Concerning the distance at which fire is to be opened there is also an approach to agreement, though in practice it will be found that the Latin races will commence earlier than the German or Russian. We may, however, take the following as giving the leading characteristics. Within the limits of infantry fire there may be said to be three zones—of short, middle, and long range respectively. The long range commences at 1,200 mètres or thereabouts and goes down to 700. Within this zone all firing must be under the strictest control, whether the men are in open or closed order; they will only fire at a given large mark, such as a column of infantry or cavalry or a battery of artillery; and the sights of the rifles will be raised to three different heights so that at least some of the balls may strike. It is not pretended that there can be accurate shooting at this distance. The number of cartridges to be fired is named, just as in the usual artillery practice. In the middle zone objects of less dimension may be fired at; but the exact target is always ordered, and the sights will usually be raised to two different distances. At this range the firing line will almost always be in open order. Under 400 mètres commences the short range zone, and here, though the fire is controlled as much as possible, and the offensive bursts of angry shooting are still considered valuable, the men are allowed to select their own marks. The *Schnellfeuer*, that is, the undirected rapid fire, is only permitted in exceptional cases, and usually for a very short period.

On the whole the general principle of the Germans, who undoubtedly give the tone to modern tactics, is not to open fire at all if it can be avoided above a range of 400 mètres when on the offensive, and not over 700 mètres when on the defensive; to keep the firing of the men under the very strictest control, and only to allow of rapid uncontrolled fire in exceptional circumstances, such as cavalry or sudden flank attacks.

Well, then, we have begun with feeling the way by a few troops comparatively, either a regular advanced guard or the head of an attack formation acting as an advanced guard, fire of an offensive character opened not too soon, and a more rapid fire sustained according to circumstances at shorter ranges, the men always pressing on, reinforcing the weakened shooting line, while a reserve is held in hand till the last moment. What now? If the enemy runs away, well and good, but probably he waits, hoping that you will run away. Now is the moment to test the skill of the commander in detecting a weak point, flank, or whatever it may be, and throwing a strong force against it. Now is seen the innate courage of the men, and the effect upon it of careful training, of a good Commissariat, and, above all, of their relations with their Officers. It is a very ugly thing to attack against breech-loaders, but it has to be done. Take your heart and throw it among the enemy, as Douglas did that of Robert Bruce, and follow it with set teeth determined to win. If you are a true soldier, if your men believe in you and you in them, they will go with you and stay with you. Is the tie between you and them stronger or weaker than the same binding force in the adversary's ranks? All depends upon that, for at this last supreme moment it is moral force which will most prevail. One side must give way. Swear that it shall not be yours. And it is to be remembered that if the struggle is severe, and tells on numbers and spirit, the same forces are tending to depress the enemy, and who knows but that a last desperate effort made by any Officer in whom the men believe may break the back of the enemy's resistance? Let us, then, hold fast by the principle that all the devices of tactics, all the means in use or suggested, have but one object in view, namely, to bring to close quarters with the enemy a force superior to his, superior, if possible, in numbers, but, above all things, superior in that moral force which all our peace training is intended to produce.

Let us now think a little about artillery, and I take it before cavalry for a reason which will soon be apparent. Some years ago I had the honour to read a paper here on the "Tactics of Field Artillery,"¹ and I now see no reason to modify anything I then said. Especially would I still advocate the use of portable shields. There is, however, a very remarkable inclination in the British Army and, I believe, in that alone, to underrate the power of this the youngest arm of the Service, an arm which did not come into full favour till the time of Napoleon, was systematically ill-used by Wellington, fell almost into contempt when the infantry received rifles and the field guns remained

¹ "The Tactical Power of Modern Field Artillery," vol. xx, No. LXXXVI.

as smooth-bores, leapt again into high fame during the Franco-German campaign of 1870-71, declined again in popular estimation, though not in that of well-informed tacticians, in the Russo-Turkish War, and has now been so much improved that nothing yet known in the history of war will compare with its effect on the next great Continental struggle. For since then not only have the guns been much improved, but good shrapnel has been introduced by every Power, and, supposing the conditions favourable to artillery fire, the man-killing power of that projectile is something like ten times as great as that of common shell.

And what was the effect of common shell in the battles between the French and Germans? On this point nothing better has been written than a short paper by Colonel Lonsdale Hale, which will appear in the April number of this Journal.¹ His careful analysis shows that the arguments which have been based on the alleged slight physical effect of artillery fire in the campaign are completely void of all significance. Pray read Colonel Hale's admirable paper for yourselves. He points out that the French guns were inefficient (and it is also true that they were timidly handled), that the time-fuzes they used would only burst their common shells at two distances, namely, 1,500 and 2,800 mètres, and shrapnel at four ranges, which lie between 500 and 1,300 mètres. Moreover, at Gravelotte, which is always quoted against field artillery, the great attack against St. Privat was resisted mainly by the French infantry because their artillery was at the time overpowered by the contest with the German guns, and, besides, had almost exhausted its ammunition. Almost exactly the same circumstances appeared in every battle—the French artillery had been overpowered before the German infantry began to enter upon the real struggle. If, then, there were few guns ready for these final struggles, how could it be expected that the losses by artillery fire could be otherwise than small?

But Colonel Hale then turns to the other side and shows that the Germans, even without shrapnel, produced great physical effect with their artillery. French reports show that their losses during the whole war averaged 25 per cent. from artillery fire, and the Battle of Vionville presents to our view a case where the French were greatly superior in infantry, which carried a better weapon than the Prussians, who yet, by their superiority in artillery, defeated their enemy and inflicted on him losses greater than their own, chiefly from artillery fire. No one can say what will take place when good shrapnel is extensively used, but this at least we do know, the armies which have been engaged in these Continental wars have since increased the proportion of their field artillery, and placed the action of that arm among the most important tactical forces.

Though artillery is a long-ranging arm, its full power is only developed at comparatively short distances, and, as infantry reserves its fire and endeavours to come to close quarters, so does artillery, according to modern tactical lights. The question of range must be affected by the possibility of finding good positions to fire from, but,

¹ "Infantry Fire versus Artillery Fire," *vide* No. CXIX, p. 247, *et seq.*

speaking generally, opinions are in favour of first opening fire at about 2,500 yards, and endeavouring to establish a superiority of fire by advancing gradually to shorter distance. At first the object is to establish a superiority over the guns of the enemy, and thus clear the way for the infantry advance, then to support that advance by firing at whatever most opposes it at any particular time, then, finally, some at least of the guns will go in heartily with the infantry to close quarters, and—let us be modest!—place that last straw on the back of the camel which shall break it.

It is hardly necessary now to spend breath in saying that artillery should be used, so far as possible, in masses, which shall be under the direction of one will, so as to be able to direct the fire of a large number of guns on one point at a critical time. Our old principle of tactics is here as peremptory as in any other case: to bring a superior force against an inferior force of the enemy at the right time and place. The massing of guns is an old principle now, strengthened lately by the additional range of rifled guns. A moment's thought will show that the longer the range of the pieces, the greater number of them can act on the same spot at the same time.

I have left cavalry for the last because the latest development of its tactics in the field is entirely based upon the importance of artillery and the necessity for its aid in a cavalry charge. It has always been understood that cavalry should combine a front with a flank attack, but now the prevalent idea is that in the attack of a division of cavalry the larger portions of the regiments, two brigades out of three, should incline to a flank for attack, thus leaving the front to the horse artillery, which should consist of three batteries. The horse artillery gallops forward and comes into action a little short of the point where the charge is likely to take place. This requires great judgment and nicety of execution, but is really safe, because the enemy cannot attack the guns without exposing his flank to a charge of your advancing squadrons. This manœuvre has been much practised lately both in Germany and Austria. It may be said generally that the direction of movement in cavalry tactics is to develop the action of the horse artillery. The diagram is taken from Von Shell's book on artillery tactics.

There is no tendency to count the days of cavalry charges on a field of battle as numbered; on the contrary, there exists everywhere a disposition to make more of the opportunities which constantly occur when the enemy's troops are broken or demoralized, or when their attention is occupied by an infantry attack and cavalry can throw its weight into the scale. The latest instance is the charge at Kassassin. Small as was the scale, the principle was grandly illustrated.

But the chief directions in which the ideas of cavalry tacticians are moving are first to strengthen what is called the cavalry screen of an army by concentrating it more; and, secondly, to develop the system of raids on the enemy's communications. The German cavalry gained a great name for itself in 1870-71, but it is a mistake to suppose that the deeds of that period are considered as models for the future. The example set by the Americans and followed by the Russians will pro-

bably become a rule of war ; and to make cavalry more independent, it is receiving a better firearm than of old, and is being trained to use it on foot. So impressed were the Russians by the value of their dismounted cavalry work that they are doing away with hussars and lancers and turning them into dragoons, who practise assiduously fighting on foot. There seems to be an idea in this country that such work will spoil cavalry. It would be difficult to say why, especially since raiding work, including often no doubt the attack on infantry of not the highest quality, is now recognized as one of the chief functions of cavalry.

I will now try to sketch in a rough way a sort of typical advance of an army corps formed like the English by three divisions, and a brigade of cavalry. Our example can but be a sort of diagram, and more harm than good will be done by presenting it unless we all understand that no two such operations will be more like each other than two human faces. The features may be the same in number and general construction, but each feature and each movement will have a character of its own impressed upon it by the Commanding Officer—its parent—and the circumstances under which it has taken life and growth.

Suppose, then, that the army corps advance on two roads, one division on each, with the third behind one of the wings. Generally speaking, each leading division will have its advanced guard, but cases may occur where a whole brigade, or even division, forms the advanced guard for the Army Corps. We will suppose two advanced guards, which will be at the least a mile in front of their divisions, and in communication with each other. The cavalry brigade has been checked in front by the advanced posts of the enemy, has reconnoitred as well as it could, perhaps dismounting and attacking partially on foot to draw the enemy. It now clears out of the way, and leaves the advanced guards to act. These move steadily and carefully, clearing their flanks as they go by patrol parties—far too little recognized in the infantry field exercise—and are in their turn checked by the gathering forces of the foe. It is now their business to seize good available positions for artillery, and in the first place to occupy them by their own batteries. To these positions they hold with great tenacity, expecting speedy help. Probably the General in command now comes up, and from this moment his character will stamp the movements. If he is a futile fidget he will want to meddle with the advanced guards. If he is a born Commander, he will let them alone, and study the position of the enemy. As in fencing, he should not look nervously at his own weapon or his adversary's, but try to penetrate the brain of the man he has to beat. His own blows should come almost by instinct.

Meanwhile the advanced guards have to be reinforced. By what arm ? Clearly the artillery, which alone has at once the requisite swiftness and offensive power at the present range, which we assume to be some 2,500 yards from the main position of the enemy. There must be no hesitation. All the artillery must come up as speedily as possible, and fill with guns the positions selected by the advanced guards,

which will now act as a support to the guns. As the two divisions have been on parallel roads, we shall have the divisional artillery on the flanks, and the corps artillery in the centre of the line of guns. All the pieces will be together if the ground admits of it, and in any case the senior Officer present will command that mass of guns where he finds himself. All distinctions become merged. For the time there is no divisional or corps artillery, only the great battery of the army corps, or even of more than one army corps. We have taken 2,500 yards as the distance, but it will be all the better if it is less.

While the artillery duel is proceeding, the infantry may be coming up, and the intention will probably be to advance in two lines with or without a third portion as a reserve; but, what with cavalry reconnaissance and the action of the advanced guards, the Commander will probably have arrived at some knowledge of the enemy's position and strength, and will have decided on his grand tactics, that is to say, on the first step from strategy to the minor tactics which must be known and practised by every Officer and non-commissioned officer. When the artillery has obtained sufficient advantage, and the general scheme is decided upon, the infantry will begin to advance. At this point let us, above all things, avoid dogmatism, and leave to the Commander to decide how his troops shall be formed, to gain the end he proposes, namely, to arrive close to the enemy with the least possible loss, and so arranged that he will have at some point or other a preponderating force, both physical and moral; such as for instance would be given by the third division making a flank attack. In deciding upon his plan he will take into consideration the great defensive or containing power of the new arms, for instance, he will not be afraid to occupy the enemy in front with an inferior force of infantry, or by artillery, with hardly any infantry, while he strikes his great blow. Here comes in one occasion for spade work.

For mere diagram purposes, let us suppose that he makes a combined attack on the front and flank of the enemy's position. Shortly after the infantry has passed the guns, and is making towards the commencement of its first zone of fire, the artillery will advance by gradual *échelon*, and take up its second position, which must be governed by the lie of the ground, but for diagram purposes we will estimate to be at about 1,200 or 1,400 yards from the enemy. At this time the opposing artillery will still be the most annoying opponent to the advance, and so long as this is the case it must be fired at. The general rule is to pour shell, especially shrapnel, on that part of the adversary which is the most active in hindering the advance.

The movement will now be slow, from the necessity of advancing carefully under cover as much as possible; but gradually the first shooting line of infantry with its supports and reserves come under fire, as we have already seen in the case of single battalions, only if the frontal attack is serious, there will not only be one line disposed in attack order, but a second at such a distance behind as not to suffer much from the fire directed against the first line. The second line will be in easy marching formation, ready to form the order of attack

at any moment. The flank attack will now be developing itself, and a portion of the great battery in front will probably be detached to accompany it. One of the special features of the artillery combat is, that any portion of the line can be used when necessary for other purposes.

So soon as the infantry is fairly launched into the combat, it becomes of course the principal arm; and the duty of the artillery and cavalry is to support it in every way, and even to sacrifice themselves for it if necessary. Therefore, if, as is probable, the advancing infantry masks the guns, the artillery, or at least part of it, will not hesitate to take up a third position, perhaps half way to the enemy. Pray let us try to get rid of that idea, retrograde, hampering, and quite contrary to experience, that artillery cannot advance to within short range, say 800 to 600 yards of an enemy's infantry. No one is going to suppose that artillery could do so alone; or that if acting by itself, it would be wise to relinquish its special quality—superiority of range; but, when two infantries are engaged in a severe struggle, where is the infantry Officer who will choose that the artillery shall consult its own safety by remaining behind, and where is the artilleryman who would do so, except under strict orders? We must remember that though the comparative power of infantry and artillery fire is of course more in favour of artillery at ranges where the infantry can hardly fire at all, yet the actual power of artillery increases enormously as the range decreases. All modern tacticians worthy of the name are of the same mind; they say that though artillery will suffer heavy losses by advancing into the front line in the later periods of the fight, yet the game is well worth the candle. The physical effect of its fire, and the moral effect of the anchor which it affords, are simply incalculable, and the General who in these days does not base the idea of his attack on a close and courageous action of his artillery, is not only behind the spirit of his time, but proposes to fight as it were with an arm tied behind his back.

The first line of infantry will by degrees absorb its supports, and probably reserves at last, into the shooting line, which, thick as it is, will be checked at some distance from the enemy, will post itself as well as it can, lie down, perhaps entrench, and commence a fire-struggle, under cover of which the second line will come up in less mixed formation, and attempt to strike a blow or a series of blows. How is this to be done? The fact is that there are probably a thousand books and pamphlets on this subject. Some writers say that the second line must above all things avoid moving straight on the first, and should therefore come up on the wings. Others say that it should march over the first line under cover of the smoke produced by the latter. I take it, Gentlemen, that when your time comes for this manœuvre you will not stop very long to weigh the various tactical forms. The longer you wait, the more your men will suffer, and the more will their nervous strength be uselessly expended. I think it will be found in the end that there will be sufficient indications of the proper place to attack, and that you will go the straightest way to that place. How to advance must be governed by circumstances. On open ground, a

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series of rushes in *échelon* appears preferable; but at any rate it is necessary to get close to the enemy, firing as little as possible meanwhile; then charge the best way you can, but, above all, wave following wave so closely that the first has not time to be broken and recoil before the second is with it to push it forward. If the attack succeeds, the artillery will be instantly pushed to the front to pursue with its fire. The attacking infantry will halt and rank itself again into steady formation, the cavalry brigade with its horse artillery will do its utmost to change defeat into rout, and keep the enemy in that state of mental agitation which will weigh more towards his defeat than all the physical power in the world. If the attack fails, it is then the business of the artillery chiefly, but also the cavalry, to engage the attention of the enemy, to draw him off from pursuing the slower moving infantry and thus enable the latter to reform its ranks.

With regard to a defensive action, the difference between the old and the new tactics is principally this: knowing that every attack will be prepared by a long artillery duel, and that it is important not to tell the enemy where the main defensive position is, the infantry will remain out of the fight as long as possible, and the artillery will occupy, if it conveniently can, a position which is not that of the main defence. As the country is probably mapped out and ranges accurately known, both artillery and infantry may open fire at longer ranges than in the attack, if it is found advisable to do so. The troops and batteries must be arranged so that the guns may take part in the final struggle. A counter-stroke must be prepared beforehand, and a general balance of advantages seems to show that the stroke should be delivered, not after an enemy's attack, because perhaps he may never be repulsed, but just as that attack is beginning, to take place, so as to disorder it.

If we now consider how the whole of the preliminary work in the attack is but a means of bringing the forces into contact, and if we estimate rightly how great are the losses to which we must submit, everybody must wonder whether there is not some other and less sanguinary means of pushing an advance. Certainly there is, but it is one which requires troops of a very high order to execute it, and cannot be attempted against a first-class enemy without more practice than has hitherto been common in any army. The method is that of the night march and attack at early dawn, which was once a favourite movement, is still laid down for the assault on fortresses, and has lately been illustrated by that fine combination of thoughtfulness, care for details, and gallantry which we call the Battle of Tel-el-Kebir. No doubt the enemy was inferior, to our side, in most of the qualities which form the good soldier, and, above all, he had no proper outposts; yet I am very much mistaken if that battle does not mark the opening of a new era in tactics, when the difficulty of the problem of night marches will be held to be less than that of an advance by day against modern firearms.

Another point must be touched upon. It is that of mounted infantry. There is nothing new in the idea of mounting infantry upon

horses or carts, or artillery wagons, or even artillery draught horses. It is no exaggeration to say that the feat has been performed hundreds of times with the greatest advantage, and will probably be performed hundreds of times more. Every nation has acted in this manner, and every nation has lately considered the question of organizing mounted infantry in peace without accepting it. In England alone is there at present a strong agitation in favour of the measure. Why is this? The answer is simple. Because we have not nearly sufficient cavalry, and the cavalry which we have, has not yet recognized its dismounted action as one of its principal functions. By all means let us train as many infantry as we can to ride in peace, but let them remain infantry pure and simple—not even attached to horses for more than short periods. Otherwise see what you are about: you are organizing a new and bastard arm, which would in the end become bad cavalry, because you have not the courage to stand up and say that the English cavalry is deficient in number, in organization, and in training for action on foot. Depend upon it, mounted infantry, permanently organized in peace, is not one of the developments of modern tactics, though a very certain development is the supply of a first-rate firearm to cavalry and its use in a variety of circumstances which have already been pointed out.

And now, what do they all come to, these modern developments of tactics? To a form of fighting which leaves more scope to individuals of lower rank than formerly, and demands keenness of insight and a cultivated judgment on the part of junior Officers. It is the development of the same idea which trusted the thin line against the heavy column, the disciplining of the Republican swarms of skirmishers. Tactics have moved always in the same direction. First the close fighting of formed masses, then the deployment of armies in line with gradually increasing power of manœuvre. Then the commencement of the swarm tactics, supported by heavy columns; and now, with better arms, the marriage of the swarm to the line, made subtler and more flexible than of old.

A strange idea prevailed when first the new tactics were used. It was that half-disciplined troops would be able to hold their own against trained armies. Never was there a greater delusion! The later tactics demand not only high discipline and training, but a discipline of a much higher kind; a discipline of the head and heart as well as of the body, together with a mastery of the rifle and the spade. Every section of a company must have its trusted leader, and absolute confidence between Officers and men is indispensable. Necessity has lately brought about some changes in the English Army which are, naturally enough, distasteful to those who have been brought up on a different system. But are we, therefore, to imagine that the enlisted Englishmen of to-day are unequal to the tasks which are not too great for the armies of the Continent, recruited by conscription? During the Seven Years' War, there were actual gaol deliveries to form regiments. We came out of it with the addition of Canada and India to the Empire. During the Peninsular War, high bounties were paid for boys fifteen years old. Now, in

peace, we enlist five or six and twenty thousand men annually, some of them younger than we wish, but all able to grow into fine soldiers. The Army is certainly not less attractive as a profession than it used to be. Let us all strive to make it more so. Let us so train ourselves that soldiers, old and young, shall have confidence in our judgment and military knowledge. It is the warm-hearted leader whom they will follow, not the captious critic who outrages their honourable feelings, and breaks their heart by constantly proclaiming that he has no confidence in them. The point to fix our eyes upon is not the fact that British lads enlist more readily before than after nineteen years of age, but that the regiments formed of men so enlisted went through the campaign in Egypt, held their own for weeks at the thin point of England's lance, made the night march steadily, and stormed the lines of Tel-el-Kebir.

List of good modern Tactical Books.

Tactique de l'Artillerie. *Von Schell.*

” ” ” *Hoffbauer.*

Règlement sur les Manœuvres des Batteries Attelées. 1881.

L'Emploi Tactique de l'Artillerie de Campagne. *Muller*, 1880.

Traité d'Art Militaire. *Perizonius*. 6th edition.

Defence and Attack of Positions. *Schaw*. 2nd edition.

L'Artillerie dans la Guerre de Campagne. *Schnéegans*.

Tactique de Combat. *Brialmont*.

Aide Mémoire de Campagne. *Costa da Serda*.

Marches et Combats. *Berthaut*.

Études de Guerre. *Lewal*.

Études, Stratégiques et Tactiques. *Rustow*.

Tactique de l'Infanterie. *Robert*.

Tactique des trois Armes. *Mazel*.

Die Neu-Russische Taktik. *Drygalski*.

Die Entwicklung der Taktik seit dem Kriege von 1870-71. *Boguslawski*.

Die Fechtweise aller Zeiten. *Boguslawski*.

Manuel de la Conduite des Troupes. *Von Widdern*.

Traité de Tactique Appliquée. *Paris*. 5th edition.

Le Tir de l'Artillerie de Campagne. *Rohne*.

Taktik. *Max Thyr*.

Studien über Truppenführung. *Verdy du Vernois*.

Service Stratégique de la Cavalerie. *Librecht*.

Das Moderne Gefecht. *L. W.*

Der Kampf um Plevna. *Von Trotha*.

Modern Tactics. *Wilkinson Shaw* { 2nd and 3rd Volumes of Military Hand-
Field Artillery. *Pratt*, 1883 .. books, edited by Col. C. B. Brackenbury,
R.A.

Tactique. *Braeckman et Ducarne*.

Tactique des trois Armes. *Fisch*.

Elemente der Taktik. *Meckel*, 1883.

Allgemeine Lehre von der Truppenführung im Felde. *Meckel*, 1881.

Zur Taktik der Situation. *Von Arnim*, 1882.

Das Deutsche Feld Artillerie-Material und Dessen Taktische Verwerthung. *Kriebel*, 1882.

Colonel LONSDALE HALE: I do not know whether it is a matter of chance that the Council selected the present year for this lecture, or whether they bore in mind the saying that "tactics change every ten years." At all events, it is a curious coincidence, because ten years ago a lecture was delivered in this very theatre on

‘The tactics of the three arms, modified to suit the requirements of the present day,’ and the Officer who delivered that lecture was the brother, Colonel Henry Brackenbury, of the present lecturer. Certainly no two Officers could have been better chosen—the one to introduce us to that decade of years, and the other to sum up its results—for the simple reason that those two Officers have probably studied modern tactics more than any two Officers in the Army. But although in one respect these two lectures are remarkably similar, yet in another respect they differ *in toto*. The similarity between the two lies in the fact that each of these lectures reflects with perfect fidelity the tone of the tactics of the days in which it was delivered; but Captain Henry Brackenbury, as he then was, stood on very firm ground. He was lecturing immediately after the close of a great war, of which we had accepted the lesson; and if war had broken out again at once we should have put the lessons which he taught us into execution. The outcome of the war of 1870–71, tactically speaking, may briefly be described as follows: first, infantry fire should be used exclusively at short range; next, the advance to the attack should be made by the formation of *échelon*; and thirdly, artillery possesses enormous power. But then a few years after that came the war of 1877–78, the tactical outcome of which was entirely different. Great weight was attached to long-range infantry fire; artillery, as the lecturer has pointed out, fell into the background altogether; and it was generally admitted that it was almost an insoluble problem as to how the last 500 yards in front of a position should be got over. The result of the conflict was to lead to an enormous amount of tactical controversy, especially on the Continent; and I do not think I am exaggerating when I say that the tactical world, or the world of tactical opinion, at the present time, is in a state almost of chaos: it is in a state of confusion, a state practically of anarchy, in which the only recommendation given us by our leaders is that every man is to do that which he considers right in his own eyes. Captain Henry Brackenbury, in the lecture to which I have referred, said—“Training during peace will alone enable an Officer to protect his troops from fire when he leads them in battle. Tactical formations must be decided upon in peace.” But in spite of those diagrams on the wall, we know that tactical formations have not been decided upon at the present time. And that brings me to the characteristic of my friend Colonel Charles Brackenbury’s lecture, in which he puts before us most plainly that truly everything is in a state of doubt. I do not know what the sources are whence Colonel Brackenbury has derived his information. Probably it is not only from the periodical literature of the Continent, but also from the regulations in Continental armies; in fact, that he has consulted the regulations of Continental armies, I am perfectly sure from one sentence which occurs in this lecture. Speaking about the distances at which the attack formation should be adopted, and the distances between the various portions into which the battalions should be divided, he says—“All must be according to circumstances.” Now, there are a series of most interesting lectures coming out in the “Revue Militaire de l’Étranger,” in which the writer complains of this characteristic of all typical regulations in Continental armies. He tells you that with one hand they give you a stick to support yourself, and then with the other hand they take that stick away from you. He tells you that in one page or one paragraph of their regulations (and the Germans, as well as others, do this) they lay down what they call a normal formation for the attack of the brigade or division, and then in the very next paragraph they calmly and deliberately tell you—“Yes, we have given you this formation: we recommend it to you for adoption, but for goodness’ sake do not trust to it. You may have to throw it away altogether and evolve something for yourselves.” Colonel Brackenbury has in other parts of the lecture truly caught the spirit of the existing state of the tactical world. Further on, dealing with the very important point, how to approach the breech-loader, the only recommendation he can give us is that we are to “take our heart, to throw it among the enemy and follow it with set teeth, determined to win.” That literally sums up what we are told to do in Continental armies. Then, again, further on, after telling us how to bring up a line to the attack, he says—“There are probably a thousand books and pamphlets on this subject.” “But, under the circumstances,” he continues, “I take it, gentlemen, that when your time comes for this manœuvre, you will not stop very long to weigh the various

tactical forms ; in fact, you would put them away altogether." And a little further on, speaking of the most difficult of all operations to be carried out, namely, a counterstroke, the only advice he can get from his wide range of reading is to tell us that "the counterstroke must be prepared beforehand." This is literally all that is contained in that paragraph. Now, there is not one tactical writer on the Continent who does not tell you that. They tell you the counterstroke is an absolute necessity ; they own it is the most difficult operation a commander can be called upon to carry out ; but I cannot call to mind one single tactical writer who gives you the slightest hint as to how you are to do it. Colonel Brackenbury also complains of our asking for a few tactical forms. He says—"You might just as well ask your housekeeper what she generally gives you for dinner." Now, I am not a big enough man to keep a housekeeper, but Mrs. Hale kindly orders my dinner for me ; and if any gentleman will ask her what she orders, I will tell you what her answer will be. She will say, "I cannot tell you in detail, but all I know is it does not do him any harm, and he rather seems to thrive upon what I give him." The military housekeeper, however, if he is asked the question, will say, "Here is what I call a 'hash of sorts,' that is all I can give ;" and he will continue, "I am not at all sure it will do you much good, but at the same time very possibly it may do you very great harm, and you may be dead five minutes after you have begun to eat it." But there is a very sound and obvious reason why there is so much doubt and hesitation as to the tactics of the future ; and that reason was given most admirably by Captain Henry Brackenbury, from whose lecture I quote again, and it is to that that I wish to call your special attention. He says, "In order to arrive at true tactical forms, the effect and power of fire must be truly estimated, otherwise false tactical forms are sure to be employed." That is just how the case stands. At the present time nobody can predict what the exact power and the exact effect of the fire of the future will be. If you take either peace experiments or the results of the war of 1877-78, the result is simply appalling. The latest development of the ideas with regard to military fire is given in a recent number of the "*Militar Wochenblatt*," where there is a review of a work by a German Officer ; and one of the axioms with which that Officer starts is that a properly equipped battery ought to be able in a quarter of an hour to annihilate the smallest object in front of it at 1,100 yards. If that be true, and if there is anything in the experiments of peace time, the result will be mutual annihilation, history will repeat itself, and we shall come again to the battle of the cats of Kilkenny. But although there is so much darkness in the tactical world at the present time, still it behoves those of us who have studied the subject to see whether we cannot find something to indicate the right path, and therefore I venture to touch upon one or two points on which I differ from Colonel Brackenbury ; and what has hurt my feelings most is his differing from me on the question of long-range infantry fire. I know it is no popular matter in the Service ; I know it is not popular with the Germans. I am not going to quote from the peace experiments at Dungeness. I will only mention one case which occurred at Aldershot, where a party put some 56 per cent. of their shots into a battalion column at 1,700 yards' distance, although, owing to the weather or the nature of the intervening ground, they did not see what they were firing at. What I wish to refer you to is to the experience of the wars of 1870 and 1878 ; for I am not a theorist, I simply cite what has actually happened. Colonel Brackenbury has alluded in too eulogistic terms to a little paper that I have written on the subject, and if you turn to that hereafter you will find something about the effect of the Chassepôt at the battle of Gravelotte. But if you do not believe what I have written, go to the battle-field of Gravelotte, stand on the ground, and see where long-range fire was used at 2,000 yards with absolute deadly effect ; and then come back if you like and say that there is nothing in long-range fire at all. I again appeal to facts, and I say, suppose you are attacking earthworks, and suppose you have 10,000 or 12,000 Englishmen going up against a line of entrenchments, why are your troops to suffer less than the Russian troops who went forward in the same way ? And we know that according to General Todleben's account, from 10,000 to 12,000 Russians were so overwhelmed at a distance of 2,000 yards that in a short space of time they were reduced to 4,000 or 5,000 men. I want you to tell

me why those Russians fell. Tell me why those Germans fell at Gravelotte, and then try and explain why, in the future, you are not to make use of this particular kind of fire, a fire which I venture to assert will be a most important element in the tactics of the future. Colonel Brackenbury has used an illustration which has come home to me with singular force. He has spoken about supposing his arm being long enough and strong enough to throw a stone over the top of St. Paul's, and that if he has an enemy there, he might stand below and pelt him for a month without effect. Quite so—that is what the man in the churchyard says; but how about the man at the top of St. Paul's? What is his view of the case? I do not know whether Colonel Brackenbury has ever been to the top of St. Paul's, but I have. I have stood on the top of the cross, and in order to get there, I had to climb up some hundred feet of most unpleasant ladders. If my enemy had been on the top of the cross, I only wish, when I was at the bottom of those ladders, that he had been a convert to Colonel Brackenbury's views as to short range; I only hope he would not have pelted me with stones when I was down below. I only hope he would have waited until I got within 20 feet of him, within striking distance, as it is termed, and then, although I should have blessed him openly for his kindness in not firing at me, in my sleeve I should have said something barely polite as to his intelligence. Then we have another point with regard to the mixing up of companies. I am sorry that Colonel Brackenbury has yielded one iota to that sentiment. I cannot help thinking that the idea of not mixing up companies is a sentiment most valuable in peace time, but which will not for one moment bear the strain and the wear and tear of Continental warfare. It is a point which occupies the attention of regimental tacticians to the exclusion of weightier matters. I will give you a few facts. I know that the idea of the integrity of the company is an old and valued tradition in the British Army; but it has derived very great support of late years from the idea that much of the efficiency of the German Army in war is due to the company system. I venture to say, and I say it in the presence of General Sir Beauchamp Walker, that it is only in peace time that the company system has its great value in the German Service. I can tell you what took place with regard to one regiment. That regiment was a thousand strong at the time of mobilization. On being mobilized it received into its ranks 2,000 fresh men; that is to say, every company has two-thirds new men. How could they, as Colonel Brackenbury has said, "each section look to its trusted leader?" But with regard to the Officers the facts are still more remarkable. Fifty-three Officers accompanied that regiment into the field of battle. Of these fifty-three Officers there were only thirty who had been with the regiment during peace: twenty-three were collected from other sources. Of those thirty Officers there were only twenty-six who were allowed even to remain with their own battalions, the others being transferred. Out of the thirty Officers among the twelve companies there were only sixteen who remained with those same companies; while out of the twelve fathers of companies, I think you are accustomed to call them in England, there were only five who were allowed to lead on to the battle-field the men whom they had trained in peace time. The regiment I am referring to is the Queen Elizabeth Regiment of Guards. Follow that regiment in its career and you will find it was at Gravelotte and Sedan. It had also some of the very hardest work round Paris, and was second to none in efficiency. The way it behaved was equal to that of any regiment in that Army, although it was working practically under strange leaders. The fact is that the *esprit de compagnie* must be merged into the *esprit* of the higher units, and eventually into the *esprit de l'armée*; and surely in no Army in the world is that merging of it into the higher sentiment more required than in an Army which has in its ranks, fighting side by side, Englishmen, Scotchmen, Irishmen, Welshmen, and the native troops of India. What I may have said with regard to the general indecision which prevails in the tactical world may be educed by some of my weak-kneed brethren into the determination no longer to study tactics, but to trust to the inspiration of the battle-field. Now, it would be foolish on my part, and absurd at the close of my military career, if I were thus to so stultify all my efforts of the last few years, to induce my brother Officers to study their profession, and specially to study tactics, and therefore I do not wish to be misunderstood. If they will accept my advice it will be this:—When you have studied elementary

tactics and mastered those, shut up all your books upon theoretical tactics: for goodness' sake do not get involved in those endless controversies which now prevail in the tactical world, for they can but lead to indecision when it comes to your turn to act. I will ask you to turn to the practical tactical deeds which have actually taken place upon the battle-field and study them. I would ask you to turn to those records of the regiments of the German Army which now lie close at your hand; read them; and you may find what corps did and what divisions did, but you also will find what companies did, and you will find what mere sections of companies did under leaders whose sole claim to authority was that the men under them can trust them. If you were to go over the ground where these scenes have been enacted, you would find that these small units have turned the impossibilities of theoretical tactics into the actual accomplished facts of victory. When you have got your minds saturated with these facts, then if your hearts are in the right place and your heads are cool, you will be able to undertake charge of the lives of your fellow men, and then will I join hands with Colonel Brackenbury in recommending you to follow the advice given us now on all sides to act "according to the circumstances of the case."

Colonel FOX STRANGWAYS, R.A.: I have no intention to detain you very long, but there are one or two points which Colonel Brackenbury has mentioned upon which I think a little further explanation may be necessary. He has laid great stress upon the necessity of pushing forward artillery as far as possible, and of taking advantage of cover; but he has rather thrown doubt upon the necessity of keeping under cover in coming into action. I refer to what he said as to the first artillery position. Now Colonel Hale has justly said, with regard to the effect of artillery, it is probably impossible to go into action at anything like close range against a well-posted artillery using good shrapnel, and, therefore, we have to resort very much I think to the practice of bringing artillery into action completely under cover, and it may be necessary to take rather a longer range than Colonel Brackenbury seems to think. There is another reason why it may be necessary, and that is because an oblique fire or an enfilading fire against troops in an entrenched position is very much more effective than frontal fire. But the main points on which I wish to make a remark is that relative to the later stages of the fight. Colonel Brackenbury has justly said that artillery ought to be pushed forward to obtain success; that everything is to be sacrificed. Now I should be the last person in the world to deny that; but the only question is, whether on the field of battle there is likely to be room for artillery being pushed forward at these close ranges of, say, 600 yards? and considering that artillery is as effective at 1,500 as 600 yards, I think we should consider whether the range at 1,500 is not much better, and for this reason, the artillery remains in the position which it has taken up, and has not the trouble of moving. It is not exposed to fire as when moving. It is able to fire over the heads of the infantry, because as soon as the infantry get to 1,000 yards they are perfectly safe from any premature shell. If a shell explodes it will explode at the muzzle of the gun; and, therefore, we could maintain a shrapnel fire at 1,500 yards, while the infantry are attacking at distances from 1,000 to 300 yards with absolute safety, and then take up percussion shell and continue it to the last moment. I would ask whether that is not the best position at which artillery should remain, with the exception of certain batteries which might be pushed forward in order to conduct success into victory? The question I would like to ask is, whether it is possible to have artillery moved forward with the infantry attack, and whether it is not better to remain in the second position with the greater part of the artillery? With regard to the question of exposing artillery, it appears to me to resolve itself into this: in an attack we want to preserve our artillery for future use; that is the reason why we would not press it forward into greater danger than necessary, so that we may not lose the horses in the first instance. The time when tenacity is to be displayed is in defence. Then the artillery holds out to the last moment, and if guns are lost they are lost rightly. The combined advance of artillery and infantry together may turn any frontal attack; for if they hold fast with extreme tenacity the attack will probably not be able to push home. But the desire to push forward to very close range in attack seems to me unnecessary and dangerous to push to an extreme.

Major CARMICHAEL, 5th Lancers: Colonel Hale has rather found fault with the Germans for leaving discretion to their Officers in action in spite of all that has been taught. The Regulations say: "Further detailed regulations and schemes are not admissible. It would not be possible to present every conceivable case, while the disadvantageous result might easily ensue that more attention would be paid to the formation laid down than to the attainment of the object itself." That I understand to be that you are to adhere to rules as long as you can; but that, if you are driven to adopt a method of your own, you must be prepared to do it; and we are told, it is a favourite practice with some German Officers to order their men to execute movements that they have never seen before, and which are sometimes actually contrary to regulations, and to expect them to do it on the spur of the moment. The next point on which I wish to speak is the position of the magazine-rifle question. Colonel Brackenbury is right in the main in saying that the Germans are taking the most advanced position in that respect, for among the *great* Continental Powers Germany is no doubt in advance of any other, but Switzerland has already actually adopted a magazine-rifle. Some time ago a magazine-rifle, the "Löwe," was tried by the Germans, and it was believed that the casting vote was given against it by a General von Gross, commanding Third Army Corps, who was afterwards killed by a fall from his horse; for when he was killed it was mentioned that the magazine-rifle was rejected owing to his vote. I understand that three regiments are now armed with an adaptation of the magazine to the Mauser rifle. But I believe there is no immediate intention on the part of the Germans to issue this rifle to the whole Army. They are waiting to see what the French will do, and they know that there will be plenty of time to make their rifles when the necessity arises. As far as theoretical opinions are concerned, on the last page of a book, called "Repeater Rifles," it is stated "That the infantry which first introduces a repeater rifle, in connection with a canister cartridge, will have as great a superiority on the battle-field of the future as, in the year 1866, the Prussian needle-gun possessed over the Austrian muzzle-loader.

The CHAIRMAN: What are you quoting from?

Major CARMICHAEL: From a German book advocating the introduction of the magazine-rifle. It is a book that came out during the controversy occasioned by the appointment of the Prussian Committee, and in it the arguments used against the magazine-rifle were combated. With regard to artillery coming into action with infantry, I may perhaps be allowed to quote what some recent modifications of the German Regulations say: "Under some circumstances it is of great value, particularly on account of its moral effect, and therefore is admissible that artillery should accompany the infantry," and so on; they do not say it is a thing that ought to be done, but it is "*admissible* under certain circumstances"; and General Goeben, who commanded in many of the battles in the north of France, when the Germans were greatly outnumbered, and the artillery had to be pushed forward to save the infantry, says, in a letter to Colonel Kriebel, published in his work, the "Matériel of German Field Artillery": "Although I have learned to know and to prize the inestimable value of my splendid artillery as a powerful and never-failing support against a far superior and brave enemy—especially during the final difficult stages of the French war, when our infantry had become numerically so weakened—yet I all the more positively declare that it is absolutely unjustifiable to incur the danger, even with the object of producing decisive results, of pushing the artillery forward until within the effective infantry fire of the enemy, and even up to the fighting line of the infantry. In my opinion the present power of firearms of both descriptions should forbid such a measure, however much an occasional instance of success with its concomitant brilliancy may plead for so daring an act, which must indeed stir the heart of every soldier." That appears to me to be common sense. If the artillery fire is effective at 1,500 yards, and the infantry at, say, 500, why should the artillery incur the extra danger of getting the infantry fire by moving up to 500 yards? This Colonel Strangways has already pointed out.

Lieutenant-Colonel MAURICE, R.A.: One necessarily restricts one's self in these discussions to speaking on those points of the lecture with which one differs, and there is no time to say how very much there is in the lecture with which we must all thoroughly agree. I am afraid I shall serve to illustrate the confusion which

Colonel Hale speaks of, by saying that my first point will be one in which I differ, both from Colonel Hale and Colonel Brackenbury. In the first place it appears to me the form of the lecture, much more than the intention of the lecturer, has tended to give an excessive importance to what seems to me almost an incident in the change which has taken place in tactics rather than to that which appears to me the essence and substance of it. The essence and substance of the change which is taking place is not that we have taken up a skirmishing form of fighting in place of masses and line, but in those points on which Colonel Brackenbury has so well touched at the end of his lecture, which I should express by saying that whereas under the old condition of fighting the General in command had to handle a machine, now he has to lead and guide a body which has become infused with a spirit and a mind of its own; and that the whole change which has taken place in tactics is that you have to consider all the facts which are connected with the movement of a body so animated with a spirit and a mind of its own, instead of merely having to regulate the movements of a machine. The old condition of things cannot be better expressed than in the words, "It is forbidden to the soldiers of Prussia to think." It was a very noble phrase; it meant the absolute self-abnegation of the individual in order to preserve unity; but it involved the assumption that thought was necessarily insubordinate and hostile to discipline. It appears to me the essence of our present condition of fighting is that we are endeavouring to develop to the utmost possible extent individual thought in order that it may contribute to unity and subordination; and that, as it seems to me, is the whole point on which the answer to Colonel Hale's complaints against the present condition of things turns. It was the easiest thing in the world to get exact regulations for the movements of an army in the field as long as the word of command which the General had to give was, for instance, that the line was to wheel a certain number of paces. That specific order so given meant that certain specific words of command were to be issued to every section throughout his army. The division was to conform by exact movement, and every fraction throughout was similarly to conform by prescribed movement. In changing to a body which moves under quite different conditions, you must develop quite a different mode of action, and one for which it is impossible to lay down exact rules. What we want is that every individual throughout should thoroughly observe the spirit, knowledge, and discipline connected with the new form of fighting, should thoroughly understand the power of the three arms, the effect of fire of the artillery and infantry, and the use of cavalry. There should be a most thorough knowledge also of the influence which different classes of ground will exercise upon each of the arms, the most thorough study of the characteristics of men, and the mode in which men act under different conditions. Therefore, I think that the whole field of tactics is enormously enlarged. Drill is no longer the one mode of tactics. All this is included under the term "organization," and becomes a means of tactical movement. That is to say, everything which tends to develop unity with the perfect development of the power of each individual link throughout the whole body tends thereby to facilitate movement in the presence of the enemy, and enables it to take place with that freedom and perfection which is the essence of good tactics. Therefore, also, I venture to dispute the passage in which Colonel Brackenbury says, in speaking of the mode in which the advance of the second line is to take "place": "How is this to be done? The fact is that there are probably a thousand books and pamphlets on this subject. Some writers say that the second line must, above all things, avoid moving straight on the first, and should therefore come up on the wings. Others say that it should march over the first line under cover of the smoke produced by the latter. I take it, gentlemen, that when your time comes for this manœuvre you will not stop very long to weigh the various tactical forms. The longer you wait the more your men will suffer, and the more will their nervous strength be uselessly expended." I cannot help thinking that that is very liable to be misunderstood. I am sure Colonel Brackenbury does not mean it, but it is liable to be misunderstood to mean that the less you study your profession beforehand, the more rapidly and the more readily you will go forward in action. I am perfectly satisfied that what he meant was exactly the reverse. For my own part I venture to say that there is a danger of an exactly opposite kind for men who have studied their profession very thoroughly before-

hand when they find themselves in action ; for some experience that might be cited tends, I think, to show that a man who has the ordinary energy of an English gentleman, who has become a theoretical student, just because he has a certain confidence in his own handling of troops, and does know how certain things will affect both the spirits of the men and their practical action in the field, has a little too much tendency to exaggerate the power which small numbers have, and therefore to push forward, where a man who had not the same confidence that he has from previous thought and previous reading would be disposed to hesitate and delay ; and that if there be a warning which any man who has very much devoted himself to the study of his profession ought to have, it is, before he goes into action, not to trust too much to his knowledge, and not to be too anxious to exercise the high spirit which he has, but to put on a check and to be cautious in the use of the knowledge he possesses. I do not believe for a moment that the tendency is the other way. I do not believe that previous work tends to make a man too hesitating ; but that, on the contrary, the man who will hesitate is the man who has not thrashed out the question for himself beforehand. To illustrate my meaning as to the extended scope which must now be given to the term tactics, I believe that as it is necessary for us to consider everything that affects the spirits and minds of our men, the order which has recently been given entrusting the education of our regiments to the company Officers has and must have the best possible direct tactical effect, not because the company Officers will not make mistakes, but because they will make mistakes and will learn from their mistakes, and because not being able to have any exact rules laid down for them, the more they come practically into contact with their men, and are accustomed to be talking to them on matters of general practical work, the more surely will they find that they have met this difficulty of confusion and doubt and hesitation which Colonel Hale thinks is so liable to occur in our present condition of warfare. And, again, for the same reason, because it seems to me that, under the present condition of fighting, the nature of the spirit we develop in different arms is the most important matter which we have to consider, I venture to differ a little from Colonel Brackenbury about the mounted infantry. I agree cordially with him in not believing that the day of the cavalry charge is past, and also in his not recommending the creation of a bastard force. I believe that the mounted infantry ought to be the most perfect infantry you can possibly have, simply shipped on horseback or on any other mode of conveyance. I cannot bring myself to believe that you will not affect the spirit of your cavalry if you habitually train your cavalry men to fight on foot. I think that a body of the best infantry that can be had, who can just barely ride but who are marksmen,¹ will be almost certain to beat at dismounted work almost any cavalry to begin with ; and also that the spirit of your cavalry will be affected by not accustoming them to feel that they are Centaurs, that their mode of fighting is on horseback, and that on horseback they are bound to win. I believe that the whole of the past history of war may be cited to prove that again and again, as weapons have improved there has been a tendency to take advantage of them for cavalry, and therefore to use them on foot ; but that wherever a great cavalry leader has arisen he has swept all that away, and has kept cavalry for cavalry purposes only. I fully agree with Colonel Brackenbury that the rôle of the cavalry is by no means limited to cavalry charges, but I do not think you can train them at the same time to be good mounted infantry and to charge home well, though I by no means dispute the necessity for their exceptional use of firearms on foot. With regard to the Prussian use of dismounted cavalry during the Le Mans campaign, it seems to me pretty clear that the Prussians at that time had nothing to do but to sweep away the *débris* of the French Army, and

¹ During the second day's discussion I received a letter from Major Lawrence, who was for several years Musketry Instructor of the 5th Dragoon Guards, and during the late campaign commanded the mounted infantry at Tel-el-Kebir. He points out the immense difficulty of getting even a few marksmen in a cavalry regiment, with all the other work that has to be done. Now, all our mounted infantry in Egypt were marksmen, and to that fact we owe the immense service they did us.

that the Prussians fully understood that they were for a specific and all-important object spoiling their cavalry for the time being. There is one other point I wish to refer to, viz., with regard to the mixing up of companies. The mixture takes place not of companies merely, but practically of whatever may be the largest units that are engaged. In the Peninsular War, divisions used to get mixed. During the war of 1870 divisions used to get mixed—sometimes corps d'armée; and I hold in my hand a very interesting letter from Lieutenant-Colonel Gordon, Sir A. Alison's Brigade Major, which, after describing the incidents of the attack on Tel-el-Kebir, goes on, just after the beginning of the fight, "I have a perfect recollection of seeing Sir Archibald on foot inside, with his revolver in hand, leading a mixed lot of Camerons and Gordons." Then a little later he says, "I lost sight of Sir Archibald in the confusion, and attached myself to a mixed lot of Camerons and Gordons." Afterwards he says, "We were joined by some of the Black Watch;" and a little later on he speaks of a place where Sir Archibald Alison and Sir Edward Hamley had both joined him. "There were present about 300 or 400 men, mostly Camerons and Gordons, and a few of the Black Watch." Now this was quite the beginning of the thing, and you must accept it as the fact that you will have not companies merely mixed, but you must be prepared for the mixture of battalions and, if they be present in the same attack, of brigades and divisions. It is not sufficient to deal with the question as if it was one simply of companies. The company question is a *bagatelle* with regard to the mixture that will take place.¹

Colonel Sir LUMLEY GRAHAM: I wish, my lord, to make a few remarks on three or four different points. First of all, I hope that Colonel Brackenbury will not think me impertinent if I defend one of his statements against gentlemen who have assailed him, for I am sure he is perfectly able to take care of himself. I allude first of all to the question of the mixture of companies. I have had for a long time a strong belief in the mistaken formation of our infantry in small companies. I have long thought that for many reasons, which there is not time to give here at this moment, it would be advisable to form our battalions into four companies instead of eight, and this not merely because the Germans do it, and because every other European army—every other civilized army has adopted the same system after having plenty of opportunity of thinking the matter out, and weighing the pros and cons—but because of the intrinsic merits of the system. One of the strongest reasons is, what has been so much remarked upon, both by the lecturer and by some of the speakers—the great importance of moral influence. Of course, it always was an important factor in war, but the importance of moral force in war has increased enormously. I am perfectly persuaded that that moral force which results from interdependence between Officers and men, the power which induces men to follow Officers almost blindfold wherever they lead, can only be produced by constant connection between the two—by the Officer becoming acquainted with his men, by the men becoming acquainted with their Officer, by the Officer always training the same men, and the men always working together. Of course we cannot expect to keep a company always in that condition, because we know there are a great many disturbing elements. The moment war breaks out there is a mobilization, and a quantity of new men are brought in. Colonel Hale referred to the great number of men brought into German regiments to make them up to the war strength, but he forgot to mention, at the same time, that in the German Army the whole of the men who came back to those companies on mobilization, the greater part of them have

¹ It is obvious that the only point of quoting the attack on Tel-el-Kebir lay in the fact that the brigades marched in regular formation up to—in the case of the Highlanders—about 200 yards from the works. Lieutenant-Colonel Gordon's letter shows in how few minutes mixture takes place, even under these conditions, so much more favourable for avoiding it than an ordinary skirmishing attack. I give this note, because in answering me Colonel Brackenbury appeared to consider that the fact of the night march in some way militated against the inference I had drawn from it. It may be noticed that the *Brigades* had no chance of being mixed up at Tel-el-Kebir, because the attacks were separated by the whole space occupied by forty-two guns.

served in those companies before. They go back to their own family in fact, the family that they have merely left for a time. They come back into their old position. It is quite true that a great number of Officers are added when the army is mobilized, but I believe the case that Colonel Hale alluded to was exceptional. It is an evil which is deplored by German Officers, but it is an evil which I do not believe exists in most regiments to the great extent that Colonel Hale mentioned. Any one who studies the way in which the company system is worked out in the German Army must, I think, be struck by the immense influence which it has had on the success of that army, and I doubt not that it will have the same influence in future. I believe firmly that any army that goes like ours into action with small companies, which are liable to be reduced to nothing after a few minutes' exposure to fire, will be at a very great disadvantage to other armies organized in a different way. Now I turn to another subject on which Colonel Hale expressed a difference of opinion from the lecturer, and that is on the subject of long-range fire. Colonel Hale, I think, treated it as if the question was only one of long-range fire on the defensive. I think Colonel Brackenbury said, and everyone will allow, that long-range fire on the defensive is a most important factor. The ranges are marked out. You know your distance from the enemy; your men are firing coolly from under cover, and they can fire volleys which will produce great effect even at very long ranges. We know by experience the fearful effects of even *unaimed* fire at long ranges, if you can afford to expend a great amount of cartridges, the greater part of which will be wasted. Colonel Brackenbury, however, was more alluding to the effect of long-range fire on the part of the assailant; he talked about pelting a man on the top of St. Paul's. Now, as he says, he might go on pelting for everlasting, and not get the man down. No doubt what he must do is to go up to the enemy and turn him out of his position. Long-range fire will not be of much use for that; you must get to close quarters, and the great object of modern tactics is to get at your enemy as quickly as possible, and with as little loss to yourself as possible. The loss is a secondary matter; the first thing is to get at the enemy; therefore, I think, with Colonel Brackenbury, that long-range fire is a thing a great deal too much insisted upon in this country. I think we err in going to too great lengths in this respect. We depend too much on the experience of target practice in peace time, producing the wonderful results described by my friend Colonel Hale. But such results would not be obtained in war, particularly if you, the firer, were in the open, nor anything approaching them. Here is another reason against teaching troops to trust in long-range fire, not to mention the waste of ammunition, so difficult for an assailant to replace, and that is that you may injure the *morale* of your troops, if you accustom them to think that, by firing at 2,000 or 1,500 yards' distance, they can beat their enemy. If they get this idea into their heads, they will never care about getting to close quarters. We *must* brave the losses, and that is one thing in which I think there is danger in our peace manoeuvres, unless we have umpires who will let the leaders of troops know that losses must be sustained, and will not put troops out of action, because they are losing some men. That is a dangerous idea to inculcate, for you must be prepared to lose men if you make an attack. Then there is another point, and that is the question of cavalry. I speak with all deference to the opinions of cavalry Officers, but I fully agree with Colonel Brackenbury that we have not got nearly enough cavalry; and rather than have special corps of mounted infantry, I would much prefer to strengthen our cavalry regiments, or to have more of them. Your cavalry ought to be able to do any of the work on foot that can be required of them; and I would ask how mounted infantry—organized in the way that we have hitherto organized them, by taking men from a number of different regiments—volunteers—picked men, excellent men, but still put together, as they are, on the spur of the moment, forming (so to say) a scratch pack; they do uncommonly well against Egyptians or Kaffirs, but if you take them to the Continent, and expect them to engage German dismounted cavalry, I think you will find your mistake. You must have a permanently organized body of men to meet such troops successfully. Therefore I think our mounted infantry—scratch packs—ought to be kept entirely for our little wars, and not for great European warfare; for that we ought to aim at having a much larger cavalry perfectly trained for fighting on foot, as well as on horseback, and I believe they are

capable of doing both equally well. Now about shields for artillery. It strikes me that if the lecturer used shields for his guns, he would very much diminish their mobility, he would at the same time make them a much better target for the enemy, and the horses above all, standing behind the guns, would hardly be covered by the shields. Colonel Brackenbury aims at bringing the artillery into the first line of battle. I dare say he is perfectly right, but he would lose very much mobility by carrying these shields, which would diminish his chance of getting his guns up to the front. The question of night attacks is one which we have all had on our minds very much, because we know that we have before us the leader of the most successful night attack which has lately taken place. But perhaps our gallant Chairman will give us the opportunity of hearing from him what his opinion is about night attacks, whether he thinks it is likely that they would be successfully made by an army of any size, by an army of ordinary European dimensions: not by surprise, of course, not falling upon an enemy badly guarded, but against an army like that of France, Russia, or Germany, properly covered with outposts properly on the look-out. I venture to think the difficulties of moving large bodies of men in the dark are so great, that even without meeting with any opposition from the enemy, in nine cases out of ten the combination would fail, that the troops would not find themselves in the right position at the right moment; the whole thing would cease to be a surprise, and the assailants would be exposed to all the difficulties of a counterstroke in the dark. If the enemy were properly provided with outposts, I cannot imagine any army approaching in the dark with success. I will close by saying how much I think we ought to thank Colonel Brackenbury for the conclusion of his lecture, in which he deprecated that practice which has grown up very much of late years in this country of crying down our soldiers. I think, as he said, that is not the way to raise the *morale* of an army. We say, "Give a dog a bad name, and you may as well hang him;" and that is very much the upshot of constantly calling out that our soldiers are not fit for this and not fit for that. I am sure our soldiers are fit for anything if they are properly trained, properly organized, and properly led.

On the motion of General Sir William Codrington, the debate was then adjourned to the Wednesday following.

Wednesday, May 9, 1883.

GENERAL LORD WOLSELEY, G.C.B., in the Chair.

Adjourned Discussion.

The CHAIRMAN: Ladies and gentlemen, at our last meeting Sir Lumley Graham remarked upon the statement made by Colonel Hale, in which he had referred to the condition of the German regiments at the beginning of the late war, pointing out how very few Officers there really were belonging to the regiments that actually went into the field. Sir Lumley Graham said he thought that was an exceptional case. Unfortunately Colonel Hale had in the meantime left the theatre; but he is now anxious, with your permission, to say a few words upon the subject.

Colonel HALE: I do not think, my lord, that the instance I adduced was at all an exceptional case. Referring to an article which has appeared in the 539th number of the "*Revue Militaire de l'Étranger*," I find the number of Captains who led their companies into the field in the German service, and the average is only 78 out of 37 regiments. The total strength of the regimental Officers is 69, and the average of the number of Officers belonging to the regiments who were with their companies when they went into the field was only 38.4. I have put up a diagram showing how the regiments took the field on the 7th August, 1870.

The 27th Regiment on entering France, 7th August, 1870.

Captains, 8.



Subalterns belonging to regiment at mobilization, 18 (5 First, 13 Second) Lieutenants.



{	Black,	{	N. C. O.'s, Portépée-Fähnrich, &c., doing Officers' duty, 16.
	Blue, or		
	Red.		



Subalterns from Landwehr, 6.



Subalterns from Reserve, 12.

No. of Co.

1

1.



2

1.



3



1.



From Reserve.

4



5



6



From Landwehr.

7



On Permanent Retired List.

8

1.



9



10



11



12



The black marks with points at the top show the eight Captains who led their companies into the field. That is above the average. The plain black marks, eighteen in number, show the only subalterns who were left with the regiment when it took the field. They made up the rest of the subalterns by drawing upon the landwehr for six subaltern Officers, and on the reserve for twelve Officers. They pulled out one poor old gentleman who is shown by no colour at all. He was permanently retired, but he became senior subaltern of the company, and then they got six Sub-Lieutenants and twelve non-commissioned officers to fill up the remaining places. I do not think that my statement altogether applied to an exceptional case.

Lieutenant-General Lord CHELMSFORD, G.C.B. : My lord, ladies, and gentlemen, the subject-matters for discussion which have been placed in my hand, I believe drawn out by the lecturer, in order to facilitate discussion, are so numerous, and embrace so large a field, that it would be utterly impossible for anyone, with the limited space at his disposal, to do justice to them. I therefore do not propose to make more than a passing allusion to cavalry and artillery, but shall confine myself to the arm I have had most to do with—the infantry. With regard to the cavalry, I endorse what the lecturer has said regarding the necessity for its being thoroughly practised to act on foot. I am sure that every cavalry Officer desires that his arm should be as thoroughly independent as possible when it takes the field, and the only way in which they can be so is by their men being instructed to act efficiently on foot when necessity requires it. I do not consider that it would be advisable to introduce mounted infantry into our service for European warfare, but I advocate distinctly keeping up a small nucleus in England, for any native wars in which we may be engaged, where cavalry cannot be conveniently employed. With regard to artillery, the lecturer naturally, belonging to that arm, has tried to prove that it is not only of the very highest importance, but of the greatest importance among the three arms. I cannot, as an infantry Officer, quite agree to that, and I confess to having been somewhat astonished to hear that he attributes the winning of the battles of Alma and Inkermann to the independent use of artillery. I certainly thought the infantry had won both actions. With regard to Vionville, which the lecturer quotes as a distinct action in which artillery won the battle, I am quite sure every artilleryman must be proud of the manner in which his arm was worked on that day. There is no doubt that the Germans handled that arm with remarkable boldness, and towards a definite object, viz., to prevent the French retiring across the Meuse on Verdun. But at the same time I do not think the German artillery can be fairly said to have won that battle. I think it was lost by the inferior tactics of the French General, who, instead of boldly making use of the superior force which he had at his disposal, allowed himself to be cowed by the German guns, which, if he had used his infantry properly, could not have stood their ground. Anybody who studies the German map of the battle, as it was between 4 or 5 o'clock p.m., will, I think, come to the same conclusion which I have drawn, that, instead of the Germans having won that day, it should have been a decisive victory for the French, had Bazaine only advanced his whole line boldly forward. With regard to the physical effect of artillery fire, it must be remembered that the principal error in artillery fire is always longitudinal and not lateral; therefore, so long as you keep your troops in line, either two deep or in open order formation, and so long as the support and reserves are not placed within such a distance from the extended companies as to catch the shots which miss them, the artillery will have a target to fire at which they will find difficult to hit. No doubt the French statistics are perfectly correct, and that they did suffer a loss of 25 per cent. from artillery fire during the Franco-German War; but it must be remembered that open order formations had not then been brought into force. I believe, therefore, that the French losses were occasioned more by faulty formation than by the accurate fire of the German artillery. I have not the time to enter into any discussion on the question with regard to the support of infantry by artillery at short ranges. I consider that artillery is best placed at about 1,500 yards from the enemy's position, where it should remain until masked by the infantry's advance. When that happens it must move forward. The further, however, it keeps from the effect of the enemy's fire, the better. With regard to the massing of guns, I

do not quite understand the lecturer. In the diagrams the guns are in divisional masses, and I am not certain whether he advocates that they shall be so massed, or that the whole corps of artillery shall be massed altogether.

Colonel BRACKENBURY: The larger the masses the better, but it must depend upon circumstances. It depends entirely upon the lie of the ground.

Lord CHELMSFORD: I cannot help thinking that the target which the corps artillery so massed would offer to the enemy, who would be able to concentrate his fire upon it, would occasion such loss as to neutralize the advantages claimed for such a formation. It would also give a splendid opening for long-range infantry fire, which I feel sure would be immediately taken advantage of by the infantry of the defence. And now with regard to the infantry. Many are inclined to think that drill can be separated from tactics; but I contend that the two are so inextricably mixed up together that you cannot tell where one begins and the other ends. The preliminary movements of the force made before its advance on the enemy's position are no doubt tactics; but when the infantry begins to advance, and comes under the enemy's fire, its movements may be called tactics, but they are really drill. The reason why our attack formation has failed in so many instances to be carried out satisfactorily, and why a doubt has arisen in the minds of so many Officers as to its merits, is because it has not been worked out as drill. Every commanding Officer practises the attack formation according to his own idea, and there is consequently no uniform system, such as there used to be under the old conditions, when we advanced in understood formation, laid down in the drill books. The method of attack should be formulated distinctly and clearly, and carried out uniformly, and until it is so, so long will it remain in the unsatisfactory condition in which it is at the present moment. I see no reason to alter the opinion at which I long ago arrived, that the present attack formation, *per se*, is as good as can possibly be provided: its whole success, however, depends upon the manner in which it is worked. The lecturer states that 2,500 yards may be considered as the distance when the two leading divisions would have to leave the road and to advance across country. Let us assume that the ground is perfectly open up to the enemy's position. The infantry must naturally get into some sort of battle order before it commences its advance to the attack, and we cannot do better than deploy into line, so that the General may understand exactly the front which the leading division will occupy during its advance. The lecturer states correctly that the object to be aimed at is to place the attacking force within charging distance of the enemy's position, as nearly as can be, in a two deep line. Therefore, unless you start by occupying the same amount of space at the beginning that you wish to do at the end, you cannot expect troops to advance in that order and with that steadiness which is so necessary to ensure success. It may be confidently laid down that during the first 1,500 yards of the advance on the enemy's position, the infantry will be under artillery fire alone. It must offer, during this portion of the advance, as inferior a target to the enemy's artillery as possible, and I consider that the present attack formation fulfils those conditions. The advanced companies need not be extended; and they and supporting companies can suit their formation to the ground which they have to pass over, and the reserve should certainly not be in column. These details may be left entirely to the discretion of the separate commanders, provided the direction of the advance be not lost, the object being to advance without firing within at least 1,000 yards of the enemy's position. Now when a long line, such as a Division, advances in attack formation upon an enemy's position, where is the opportunity for independent battalion action? Each battalion must move straight to its front, so that the whole line may reach the second stage of the attack (when it comes under infantry fire) in as good formation, and with as little delay as possible. It is a purely drill movement, where each unit has its allotted place. The lecturer says that the battalion commander must keep his four reserve companies in hand to strike when and where he chooses. I deny the "where" altogether. "When," of course, must be left to his discretion. He would wish naturally to keep them together as long as he can, so as to have them in hand, and not mix them up with the companies in the fighting line until the last moment. As regards the "where," however, he has only got the front of his battalion to manœuvre in, and therefore, if he moves his reserve companies outside that front, he at once interferes with the

battalions on his left and right. The whole secret of a successful advance to the attack consists in each battalion unit preserving its proper direction. When the attacking Division arrives at that point from the enemy's position, when it comes under its direct infantry fire, the conditions of the advance become changed, but the broad principles which guided its advance during the first stage still hold good. The attacking line may have to open fire, but it must be distinctly understood that this act should be deferred as long as possible—for two reasons, first, because firing will delay the advance; and secondly, because it will be very difficult to replenish expended ammunition in the advanced line. The advance by alternate units, either brigade, battalion, or company, covered by the fire of such portions of the line as may happen to be lying down, and assisted by the corps artillery, should enable the attacking Division to get within charging distance of the enemy's line. Should it not do so, there are only two alternative measures which can be adopted, viz., for the line to remain lying down where it has been checked until reinforced and equal to another effort, or for it to retire straight to the rear. There is no manœuvring possible under close infantry fire. The attacking force is committed from first to last to a movement to the front, or a movement to the rear. I can only make a few remarks upon a force acting on the defensive. The lecturer has alluded very briefly to this branch of tactics; but it is well that we should bear in mind that during the Peninsular War we won nearly all our battles by acting first on the defensive, and then making an offensive return; and I am inclined to think that the management of our troops in battle in the way most in accordance with the characteristics of the British soldier is good policy. I am quite aware that the Germans have come to the conclusion that the attack always has an advantage over the defence, but they are thinking of themselves, not others. Our troops have always shown a steadiness under fire of which we have been justly proud—a steadiness which no other nation in the world could rival—and we have always been able, at the critical moment, to make that offensive return which is, of course, the important point in a defensive fight. I believe, myself, that in the wars of the future, should we ever have to take the field against a European foe, the defensive-offensive action will be found still to carry with it the great merit that it was found to possess during the Peninsular War. With regard to the night march, and attack at dawn, which the lecturer considers will play a prominent part in future wars, one can clearly see how desirable it would be to devise some plan by which we should be able to get over, without much loss, the 2,500 yards which separates you from your enemy's position. I do not see, however, so far as modern European war is concerned, how that is to be done in the dark. The enemy's outposts will certainly be out so far as 2,500 yards in front of their position, and when they find out that you are advancing upon their position they will open fire. They would be reinforced, and a night attack would commence. Now I believe nothing could be more injurious to the interests of the attacking force than to find itself surprised instead of surprising: the whole of the troops composing that attack would become utterly demoralized. There is one other point to which I wish to allude which has special reference to a force acting on the defensive. It is curious that the lecturer should not have made any allusion to the employment of machine-guns. I know that machine-guns are not looked upon with much favour by the artillery, but I hope we shall soon see the day when machine-guns will be so improved and simplified that they can be handed over completely to the infantry. On the defensive, with our small Army, the employment of machine-guns would increase our power enormously. We could then place a small portion of the defending force in the front line, and keep the large mass of troops in hand ready for the counter-attack. The lecturer advocates the employment of magazine rifles, but I very much question whether their issue would be advisable. In conclusion, I would add how much gratified I was to hear the lecturer say at the end of his paper, that "later tactics demand not only high discipline and training, but discipline of a much higher kind." I am quite sure that that is the right spirit in which we must look at the question, and I trust that all those who have anything to say to the teaching of modern tactics will bear those words in mind.

Lieutenant-General Sir BEAUCHAMP WALKER, K.C.B.: My lord, ladies, and gentlemen, so many points which I have thought over since this lecture was delivered a few

days since, have been touched on by Lord Chelmsford, that I have really very little left to say. There are, however, one or two points on which, perhaps, I may be able to afford some information. I think that Colonel Brackenbury, by adverting in the terms he has done to the mixing of companies, may produce something like a scare in those who, until our formation is altered, will probably have to fight under our present organization. I do not think our present organization will lead to a bit more mixing of companies than was the case in the two German wars of which I was a spectator. The text on which Captain May hung his remarkable work, "Tactical Retrospect," which first set the question going, was the mixture of companies. As would naturally be supposed, the great authorities at Berlin, who leave no subject untouched, looked to this as one of the most important questions to be solved. During the war of 1870-71, I found the mixing of companies, of battalions, of regiments, and even of brigades, was as great an evil as it had been in the war of 1866. I do not really see how, even with the most careful drill—and nobody is more desirous of upholding careful instruction beforehand than I am—anything else is to be expected in the present day. As long as the loose system of fighting is adopted, you must have this inevitable confusion taking place. I have always believed that the reason why no advance was made after the battle of Königgrätz, was that there was such an inextricable confusion of the units of the army that it was impossible to advance without twelve hours to put the men back in their own companies, and the companies back in their own battalions. I therefore think I may, perhaps, not be out of place in giving a slight warning to those who have not equally considered the subject, that this mixing of companies is an evil which has not yet been avoided in the most drilled and effective army of the present day, and that we need not be frightened by a scare of that description. There is another point on which I am anxious to say a few words, because I think Colonel Brackenbury has been a little misunderstood by those who listened to him last Friday, and that is where he speaks of the "1,000 books and pamphlets." I do not know whether I have entirely grasped his idea, which is that everything must be left to the inspiration of heaven-born Generals. Well and good, you get a heaven-born General once in fifty years; but I do not think you will have heaven-born subalterns, and Captains, and Majors, and Lieutenant-Colonels, in such a vast number that you can trust to any inspiration on the field of battle, leaving a man to do the right thing at the right moment, unless his mind has been thoroughly indoctrinated by it before. Now I hope you will acquit me of egotism if I give you an idea from my own experience. I went late in life into the cavalry, and I believe in the three years of my first command of a squadron, I was able to handle that squadron as well as most men; but how was that? Because I so thoroughly indoctrinated my mind with every possible position in which that squadron could be placed that I had nothing to think of when the time came. When an order was given, I knew what was to follow; and that, I believe, is the true way of drilling up to tactics. Colonel Brackenbury, of course, will have the opportunity of telling us exactly what the allusion to the "1,000 books" meant. I can only say that I have derived the foundation for the opinions I have formed by reading nearly every book that I could lay my hands on, in which everyone who takes the trouble to elucidate so interesting a subject as this has published his ideas; and it is after comparing the different systems that one at last comes to a conclusion as to what is the right thing to do in the right place. But you must have instilled into your mind a positive knowledge of what can be done with the unit or units which are under your command; so that you will not have to deliberate when you come into the difficulty of a great general action, but you know at once, "This must be met by that which I have thought out, and which I have satisfied my own mind is the right thing to meet it." I should much like to have said something about cavalry, but there is really no time; I therefore turn to the closing subjects. I do not think night marches and surprises, notwithstanding the great and almost unequalled success which attended the last, will lead to their being applied in the future one bit more or one bit less than they have always been applied. As Colonel Brackenbury has alluded to Tel-el-Kebir, and as my old friend and comrade, Lord Wolseley, will be perfectly certain that I do not intend to pour the only English sauce, namely, melted butter, on his head, I may say that it was the type of a

night march and a surprise, admirably thought out (as I have reason to know from some of those who first returned home), most lucidly explained to all who had to carry out his views on the previous day, perfectly carried out by the troops under his command, and supplemented by what so seldom takes place, the pushing forward of cavalry to reap the fruits of your victory. But I do not think the example of Tel-el-Kebir will lead to the use of night marches and surprises one bit more or one bit less than has always been the case. It is an operation which can only be carried out under peculiar circumstances, the value of which must be carefully weighed before the great risk is encountered. The first one of which we hear was the geese of the Capitol, of which there was a picture in the Exhibition last year. Quebec was a night march and surprise; Inkermann was a night march, and Inkermann is a good example that should be studied by everybody who endeavours to carry out a night march. If the two columns had not—perhaps from some misconception of orders, from the darkness of the night, and want of knowledge of the ground—crossed their heads, I do not think we should have turned them off the field at 2 o'clock in the day. Königgrätz was a night march, but not a surprise, because the Austrians had good outposts. Sedan was a night march, and was very nearly ending on the extreme right of the French position in a very different result from what was expected. So thick a fog fell, that the troops, which we knew had marched at the very earliest hour of the morning, never came under fire until 11 o'clock in the day. I started at 3.30, and with the staff of the Crown Prince we were at the *rendezvous* at 6 o'clock in the morning; and we waited there until 11 o'clock before the two corps that marched round the bend of the river fired a single shot. The most successful night march and surprise as a picture of war was, perhaps, that which took place in 1811, when General Hill, with two brigades of infantry, two regiments of cavalry, and some guns, surprised Girard at Arroyo de Molinos. Hill marched at 2 o'clock in the morning. He had only one league to march, and he never got there until between half-past 6 and 7. It was a wet, stormy night; the French had neither outposts nor patrols, and the surprise was complete. With one brigade he marched down the main street, the pipes playing "Hey, Johnny Cope, are ye wakin' noo?" while the other brigade marched to the rear of the village, and they simply bagged the whole lot. Mounted infantry will, I hope, never be introduced into the English Service as an established force, organized and kept up at great expense in time of peace to do what, I say, the cavalry ought to do, and are able to do in war. The reason why we use mounted infantry is that nearly all our operations take place with the sea for a base; and instead of, as in land warfare, the cavalry forming the advance of the army, the cavalry do not arrive until the greater part of the force has been landed. If the cavalry are pushed forward in front of the army, I see no reason why they should not undertake the whole duties which are now performed by mounted infantry. I cannot believe that the use of a good firearm, and the power of acting on foot when required, will in any degree deteriorate from the value of good cavalry. The Germans have organized the whole of their cavalry with firearms. They have not gone to the extreme that we have of giving a carbine to every lancer, because they only arm a certain portion of each squadron with carbines, but the whole of the remaining cavalry is armed with carbines except the cuirassiers. We are the only people who give carbines to our cuirassiers, it being well known that a man with a cuirass cannot put a carbine to his shoulder. I do not think it was ever intended that cavalry should do habitual duty as infantry on foot. I think it is intended that cavalry, armed with a thoroughly good and reliable carbine, shall be pushed forward in advance or to the rear of the enemy, be able to hold any post to which they have taken possession—a bridge, for instance—until such time as will enable the infantry to come up; but I do not think anybody will consider that cavalry are intended to act as infantry in the line of battle. The last point to which I shall advert is the responsibility of junior Officers. It is a most undoubted fact, that I think the responsibility goes a great deal higher; I think great responsibility is thrown on the junior Officer by the great advantages that may be gained under the present style of fighting; but a far higher responsibility is thrown upon the senior officers, and until you have senior regimental Officers who are thoroughly able to instruct their junior Officers, the right nail has never been hit on the head. Now, I

never lose an opportunity, when I speak in this theatre, of giving my experience as to what the junior Officers of the British Army are at present. I have had now for five years to perform the duties of the most distasteful office in the British Army, that of making gentlemen who have not studied their profession study it, and give proofs that they have done so. And I should be doing very great injustice to the juniors of the British Army, if I did not say on every opportunity that occurs to me, what my experience has been. I said not very long ago in this theatre that there are men who will not learn anything, grumblers who will not learn anything that they are not obliged to do; but the general feeling of the young Officers of the army, and of men in junior ranks who are no longer young, and to whom, therefore, this infliction has been still more distasteful, has been most admirable. This infliction has been met with perfect cheerfulness, and the results have been excellent; and I can only say that in several instances gentlemen who had come to me, and had asked to be excused from going through this test, on the plea that they had learned nothing during their previous service, and that it was very hard, therefore, for them to go to school in their old age, have come to me afterwards and said, "Well, we thought you very hard, and you always are; but we thank you now for having enforced that which has given us, for the first time, a real interest in our profession." If that is the spirit of the young Officers of the British Army, and I unhesitatingly say that it is the spirit of the great bulk of them, I do not think it matters much what changes are imposed upon them, what type of attack they have to adopt, what form of formation in the field: the result will be as ever, they will come up cheerfully to what is required of them, and will show that the future has only looked to the past for an example.

Major PRATT, R.A.: I shall confine myself strictly to two points. Firstly, the lecturer alluded to the power of artillery. Of course we all admit that artillery *matériel* is increasing enormously in power; but I do not think we have sufficiently recognized the amount to which the *personnel* of the artillery has been increased on the Continent. In the most recent additions to their army the Germans, while increasing their infantry 7 per cent., augmented their artillery by 13½ per cent. Without going into the number of guns per thousand men, which is a most misleading calculation, I believe it is a fact that the German Army Corps of 1870 and 1883 virtually consist of the same number of men, and we know they have practically added two batteries to each Army Corps. With regard to how we should get this power for our own service, of course it is rather a difficult thing to decide. Our Army Corps and Divisions exist to a great extent for artillery organization upon paper, but I think for home Service we might do some good in getting our batteries at the big stations—where it is practicable to work together as divisions of four batteries—putting them under the command of one Officer for drill and organization purposes. Before leaving this question, I venture to point out one way in which I believe the power of artillery can be very much enlarged. For these many expeditions which we undertake in all parts of the world, I plead for one unit of our Army which has hitherto been much neglected. It only exists in two or three small stations in India, and it has probably done more hard work than almost any other unit in the Army. If you refer to the war of 1876, I think one of the most interesting lessons to be learnt is the very striking way in which mountain guns did their work, not only in mountain warfare, but actually working as field guns; and I venture to point out a fact which may not be known to everybody here, that the mountain gun of the present and especially the mountain gun of the future, will be very different from that of the past, and that it is essentially a field gun carried on the back of mules. We make our present guns in two pieces. There is one being now manufactured of steel which is capable of being carried by mule transport, and will fire a 10-lb. shell with a high velocity. I conceive that the use of mountain artillery of this type would do away with the chief *impedimenta* of artillery, which is so often found in the way in taking it into semi-civilized countries. Colonel Brackenbury pushes forward his artillery to a third position, and says in his notes, "Pray let us try to get rid of that idea, retrograde, hampering, and quite contrary to experience, that artillery cannot advance to within short range, say 800 to 600 yards, of an enemy's infantry." Now, sir, I should like to refer to what was said by two Officers at the last meeting. In the first place, I do not think we quite

understand what Colonel Strangways' views were. He wanted, apparently, to keep back the artillery to some 1,500 yards from the position, but he further added that he could conceive we could have an attack of infantry with the artillery, under normal conditions, firing over their heads. I believed that idea was exploded, but think it really is a question for the infantry to decide. If we are going to carry out an attack with artillery firing over the heads of the infantry, we must practise the manœuvre in peace time. With regard to ranges of from 600 to 800 yards, I am afraid I must differ from Colonel Hale. I have been for the last six years endeavouring to drive into the heads of cadets some of the elements of tactics under rather discouraging circumstances; but if we are to take Colonel Hale's ideas, that the whole tactical world is in a state of chaos, how are we to deal with tactical instruction? We had better abolish military education altogether. How are we to recommend the study of tactical books, or lecture on the experience of the past? I come here as a humble disciple of Colonel Hale, who has had so much to do with introducing the study of tactics at the Staff College, and I ask him for some tactical food. What does he give? A pennyworth of principle, and he asks us to wash it down with an intolerable amount of sack which he calls "circumstances." I venture to think we can get, by looking abroad, some little crumbs of comfort. I would appeal to those Officers present who are so well up in foreign military literature as to what they are doing on the Continent? We find a certain amount of standard books which come out constantly in new editions, and are brought up to date in accordance with the experience of modern wars. It is upon them that the different instructors at the military schools base their lectures. Then, going a little further, we want some stronger meat. We get it from Officers of experience in war, such as General Verdy du Vernois, Colonel von Shell, General Berthaut, General Dragomirow, and several others. The whole of those authors are not in a state of chaos, and they inculcate most distinctly what I call the close order of fighting which Colonel Brackenbury has so ably described. With regard to what I may call the third and rising school, of which Colonel Hale is so admirable an exponent, I think that we do not quite realize about this long-range fire. Immediately after the war of 1870 all nations tried to reorganize their armament; and if you take the different dates at which the new weapons were brought forward, the different rifles, and the various artillery equipments, you will find you can fix upon the year 1873, when you had virtually a new equipment both of artillery and infantry, which differs very little from the modern small-bore rifle and the future gun as we intend to have it. From 1874 until 1883 there has been a constant succession of these experiments of long-range fire. It is no new thing, but occasionally when other matters are not on the *tapis* there is a tendency to get hold of these enticing principles of long-range fire. I believe what I may call the tactical constitution is firmly established. We have got good text books; we have got pretty nearly all the headquarter staff of every Continental nation of Europe to agree in principle, and against them we have theories based on a certain amount of detail as to the experiments of long-range fire. The Germans, who have taken up the thing so strongly themselves, ignore the results of it, in so far that they say the best way to deal with long-range fire is to get to close quarters.¹

Colonel GONNE, late 17th Lancers: My lord, as a cavalry man, it may seem rather extraordinary that the few remarks I am about to offer touch the infantry and artillery, and I shall confine myself to the question of tactics. We were all rather staggered to be told by our professors that tactics were without laws, and were hardly guided by principles. Now I am not sufficiently John Bull to raise my voice against copying that essentially warlike nation, the Germans, who really have the cream of the talent

¹ No one denies that long-range fire will be valuable in exceptional cases, and, notably, when acting on the defensive, or that the preparation of an attack by fire may have to be more carefully worked out. In common with many others, I do not, however, believe that the range experiments at Spandau, Steinfeld, St. Maurice, &c., combined with questionable deductions from the war of 1877, are sufficient to cause any material alteration in the principles upon which the modern attack formations are based.

of the nation in their army, and I differ in opinion from those who assert that the German "order of battle" in the present day will resemble that which it was in either the war of 1866, or the late French War. What have the Germans lately done? The company column holds exactly the same name and esteem in Germany as before, but they have discovered that it is positively necessary to curb and guide the private soldiers. They do this in every particular, but more especially as regards fire discipline. The whole of the training of the German Army turns upon not letting the men out of control of those who are immediately in charge of them. Now, as regards firing, I have been able at last to ensure an absence of useless fire by throwing the responsibility of the ranges on the Officer. Volleys are fired, and the spot where the bullets touch is watched by the Officer or non-commissioned officer who gives the command, and then the range is declared to the men by an order as to placing the sight. They fire volleys only for long ranges. This may be called unaimed fire, but you will find in every peace exercise, to show that it is their habit in war, a certain number of volleys are fired at the beginning of an action. The quick fire is only allowed when the men are placed out of hand, and are on the very eve of attack with the bayonet. The repeater rifle, which they have been practising with, is intended to be used merely for this late stage in the battle. If they adopt a repeating weapon, it will be one that they can fire in the ordinary way, until the order for quick fire is given. Every Continental nation copies the Germans, and if you happen to be attached to the Austrian or Russian armies, you will always know every change that takes place in the German Army, by watching the autumn manœuvres. Such was the case in Russia last year as regards large cavalry manœuvres. The Russians heard that the Germans had carried out manœuvres with masses of cavalry, and they did the same thing in the Odessa district. I think we ought to learn something from the tactics of the British Army in the last campaign, and here I come to the question of the efficacy of field artillery fire, as we have seen it up to the present date. When the British Army moved to Ismailia, I think I am right in saying the first troops to disembark were cavalry, and the cavalry were the antennæ of that red insect which afterwards ate up Tel-el-Kebir—an insect now of a chameleon nature, I regret to say. The cavalry, so to say, screened the disembarkation of the infantry, and were exposed to a very heavy fire from the Egyptian artillery. Although the Egyptian guns may have been faulty, they fired the old percussion shell, and I am told that they were admirably served. The shells plumped in among the troops, but did no harm, for the simple reason that the fuze was not sufficiently sensitive, and the shell buried itself, and made no dangerous crater. Another extraordinary thing happened at this moment. You may say the Egyptians would have had the pluck to attack if it had not been for the accurate rifle-fire of some mounted infantry. I am told by those who were present that when the Egyptians showed any sign of coming on to attack the screen, which was not desirable at that special moment, because the infantry, though on the march, were not actually on the battle-field.—I am told the men who were most prominent were seen to throw up their arms in death agony; the fire had been so good that individuals were shot. That perfection of aim you will never get from dismounted cavalry—so here I recognize a distinction between the dragoon of Russia fighting on horseback or on foot, and the mounted infantry who proved so useful first of all in the neighbourhood of Alexandria, and who actually prevented the Egyptians from making an advance when the disembarkation was scarce complete at Ismailia. I assert that although the guns were well served and pointed, they killed nobody, and that is not the only instance. If you really search for examples, it is safe to assert that the guns around Plevna did not, except by forming lines of circumvallation, precipitate the fall of Plevna by one hour; and you may believe that the guns of the British force landed at Ismailia had nothing whatever to say to the fall of Tel-el-Kebir. I am quite aware that now we are about to introduce a new gun and a new shell—that means a perfection of the shrapnel shell, with a good time fuze. As yet we have not had it. If we were going to trust the percussion shell, I should say the artillery has been, and is very little more than a moral force in the field, and a very strong moral force, but not a physical danger. It will be otherwise, I have no doubt, with the improved shrapnel, but that remains to be proved hereafter.

Major-General J. H. DUNNE: When I sent in my name to make a few observations, it was because very little was said in last week's discussion about infantry; but after all that has since been said to-day, by two such able exponents on the subject as Lord Chelmsford and Sir Beauchamp Walker, my few remarks are hardly justified, except perhaps from the circumstance of my having had some fourteen years' experience in commanding a regiment, and some four years in commanding a brigade *dépôt*. The lecturer, alluding to the attack of infantry, and some of the speakers who followed him, expressed grave doubts as to our attack being the best, owing to the mixing up of the men, and the loss of that *esprit de compagnie* which the lecturer seems to think is almost as valuable as *esprit de corps*. Doubtless in foreign armies, where there are large companies of 250 men, a great amount of that mixing up is to a certain extent obviated. But Sir Beauchamp Walker considers this of very little consequence! In my unfortunate country, where I am afraid an army of occupation must exist for many years to come, there are a vast number of small barracks, in which it would be quite impossible for anything but the old-fashioned companies to be posted. When in Ireland some years ago, my own regiment had seven companies on detachment. Each of these companies was a separate unit in itself, and there was that company emulation to which the lecturer alluded, and any Captain worth his salt made it a point of honour to bring back his company to head-quarters in as good condition as adverse circumstances would permit. Therefore, as long as our army has to be scattered and broken up in detachments all over the country, it would seem that it would be better for us to continue the company as we have it at present, unless it can possibly be managed that subdivisions of large companies should be given the same staff of Officers permanently attached to them as our present companies have. Between 1867 and 1877, there were, I think, at least four or five different systems of drill attack, more or less authorized, amongst infantry. No sooner had the Commanding Officer drummed the whole of one drill of attack into his men, than out came another, and the difficulty was to unlearn the old drill and begin afresh, and, moreover, every battalion was liable to be experimented upon by every General under whose command it was, and all his theories had to be worked out. Since 1877 there has happily been no change in the drill of attack. If there is now to be another change, let the very best head-pieces of our army be got together to devise a drill of attack which may have something of finality in it, for as our army is now constituted, it is impossible to be continually teaching the men different drills of attack. The principles of that drill must be thoroughly learnt by all, and we have far less time now to teach our men than formerly. As has been said, this drill requires more training, more individual intelligence and self-reliance than the old humdrum battalion drill did, and much more will be required of young Officers in the future than has been the case in the past. There are no doubt a number of high spirits, young Officers, who would be as good as ever in a campaign, but who from various causes will hardly devote the time that is now required to impart instruction in drill, musketry, and everything else to their men; and if the work is so irksome to some of this class, that they leave the army, surely there ought to be more professional advantages held out to those who remain, and give the best years of their life to the profession, toiling daily in instructing fresh levies of troops; surely they should not so labour with the risk of finding themselves—through the accidents of slow promotion—relegated to idleness on a pittance of a pension at the age of forty! It has always been the great grievance of Commanding Officers, especially in large garrisons, that they never could get a drill with the whole of their men, an enormous number being always taken away for standing fatigue duties, for Staff employ, and as permanent orderlies to all sorts of officials. As long as the old system lasted, this did not really so much matter, for a Commanding Officer took care to give these "billets" to old soldiers so thoroughly imbued with drill that they were always ready to go through it without mistakes when pulled out for a General's inspection, or some very special field day. But with our new system of short service this cannot be the case, therefore let it be so arranged that Commanding Officers should either monthly or quarterly have their *whole* battalion handed over to them for a few days' instruction, and on those days, let not a single man out of hospital be absent on any pretence whatever. It is only then that a Commanding

Officer can be fairly held responsible that his men are "able to go anywhere, and do anything." If this is done, Generals, with the present stamp of infantry soldiers, will be enabled to develop in action this the most important of the three arms, as well in the future as ever has been done in the past.

Colonel BRACKENBURY, in reply, said: I only wish to say a few words, and there is the less reason for my saying much, because nearly every statement that has been made by one speaker has been answered by another, so that I have very little trouble indeed so far as argument is concerned. There are, however, two or three points which must be gone over a little again, because they may be explained to a certain extent. With regard to long-range fire, no one, I believe, would say for an instant that it is of no use at all; such an exaggeration would be foolish. There are conditions under which long-range fire may, undoubtedly, be used with advantage, but it is not the long-range fire which is going to win the battle. That is the point. At last you must come to the closing of infantry, and then there is no place for long-range fire. Occasions such as the defence of works, when there has been plenty of time to take ranges, and the ground is perfectly plain, are suitable for long-range fire, and others of a kindred nature may present themselves. There was sent to me this morning an excellent article from the "Manchester Guardian," on the lecture that I had the honour of delivering, and it quotes what I confess I had not noticed—the last official utterance on long-range fire. It is by a French Committee, which has just brought out a new book for the instruction of the Army, and in quoting it we should remember that the Latin races, the French and the Italians, are more inclined towards early and long-range fire than the northern nations. Here is the passage quoted by the "Manchester Guardian":—"To fire at a distant object may result in shaking a body of the enemy, in delaying its entry into action, and thus increasing our chances of subsequent success. It may render difficult the occupation of an important point, such as a bridge, a place where four roads meet, or the issue from a defile which the enemy must pass, but it rarely produces decisive effects. It is, above all, at short ranges that a great number of cartridges and rifles is needed, in order to be superior at the decisive moment, when firing produces its surest and most powerful effect." In other words, infantry may do to a slight extent at their long range what is the duty and the easy work of artillery at that range, but let them beware of wasting ammunition. With regard to the mixing of companies, Colonel Maurice quoted the battle of Tel-el-Kebir, where, undoubtedly, companies were mixed, as they were mixed, I suppose, in every charge which has ever taken place in the history of war. But what was that battle? There was no advance by daylight, against a force resisting our troops. It was exactly the opposite of the advance shown on these diagrams which you see before you. The advance was made by night, without opposition. The infantry arrived, without firing a shot, at the point to which it is wished that they should arrive, after all the trouble which has been taken during the long advance shown in the diagrams. Therefore, the action at Tel-el-Kebir does not the least in the world affect this question. In such charges, of course companies, battalions, and brigades, as Sir Beauchamp Walker has so rightly said, would probably be mixed up; but what we want to avoid is mixing them, if it can possibly be helped, in the long advance before the charge, so that we may bring at last into close contact with the enemy a force which shall be homogeneous, which shall be under the hand of its Officers, and ready, therefore, to be used in whatever way those Officers desire. Then we turn to the artillery. Now, unluckily, I am an artilleryman myself, and so handicapped in an argument. And worse still, my views on the subject are opposed, to a certain extent, by a brother artilleryman, Colonel Strangways. In arguing on this question I always find that writers and speakers compare artillery fire at 2,000 yards, or thereabouts, with infantry fire at 200 yards. Well, if you are going to talk about infantry fire at 200, or 400, or 1,000 yards, then put your artillery in the same place, and consider what the physical effect of the fire is. That will be a fair comparison. There were experiments made at Okehampton, some years ago, which would give you some idea what the physical effect would be, supposing, of course, that there were no infantry fire against the artillery. It so happened that a discussion was going on one day in the Intelligence Department between myself and one or two Officers on this very

subject. My views on artillery fire were questioned, especially that artillery fire is very much more deadly at close than at long ranges. I asked one of the Officers if he would make out a programme, and we would try and get it carried out at Okehampton. The consent of the War Office was obtained, and Colonel East went down to see that the test was a fair one. The result was this, that when firing at 1,500 yards, against a very large cavalry target, 11 per cent. of the men were damaged in one minute. At 1,000 yards, firing at a much smaller infantry target, 18 per cent. were put *hors de combat* in one minute. At 600 yards, 33 per cent.; at 400, 40 per cent.; at 300, 50 per cent.; and at 100 yards, 75 per cent. in one minute. Now, I do not say that this is what would occur in battle,—that is quite another consideration,—but it merely shows the proportional physical effects of artillery, going down from 1,500 yards to 100 yards. In all such experiments, whether with artillery or infantry fire, deductions must be made for the effect of the enemy's fire against the shooters. Then Colonel Strangways spoke of the necessity of preserving artillery for future fighting. Why on earth are we to preserve artillery more than cavalry or infantry? Why is artillery to say that it alone is not to face the danger which the other arms are to face? It so happens that the argument is rather the other way. Every cavalry man who is killed is gone with his horse and arms; every infantry man is gone with his rifle and bayonet; but every artilleryman who is killed is not gone with his gun: his gun stays there, and you have only to feed it, and feed in a very small proportion, with reserves, and you will probably not lose a single gun. It seems to me that artillery is better able to sacrifice itself, without losing its efficiency, than cavalry or infantry. Only one word with regard to shields. My proposal when first made differs from all former proposals, in that I do not wish to carry the shields on the guns, which would overweight the equipment, but to carry them separately, and I believe that in such a change will be found at last the key to a very difficult question, how artillery is to face infantry at close quarters. Experiments were made, at my suggestion, by Sir William Armstrong. It was found that very excellent shields could be made, and that one carriage per battery would carry sufficient to protect the whole six guns, or that they might be carried on two waggons, which would each have a limber of ammunition besides, so that it is not necessary to make a very great addition to the battery after all. With reference to a remark of Lord Chelmsford, I did not quote Alma and Inkermann as battles won by the action of the artillery, but merely as early instances of using English guns independently, and arguments against the idea that the independent action of artillery is useless. Then, as to mounted infantry. I believe that the average of the views expressed in this discussion has been rather in favour of dismounted cavalry. My own experience with regard to the question is perhaps unique for an Englishman. I was present at, I believe, almost the only really important actions of dismounted cavalry which have taken place in Europe in modern times; that is to say, during the first advance of the Russian cavalry over the Balkans under General Gourko. There were about 10,000 men altogether, a large proportion of them being cavalry. We penetrated from the Danube through the Balkans perfectly alone, as first a cavalry advance, then a flying column, and went right into the middle of the Turks. I saw the dismounted cavalry capture Eirnova, defended by 3,000 infantry and several guns. Again, they captured Kasanlyk acting on foot; and over and over again I saw excellent work done by dismounted cavalry. Afterwards, when it came to the great battles of Plevna, and so on, there was no place either for dismounted cavalry or mounted infantry, and therefore you cannot quote against them the fact that they did nothing. It is only in exceptional cases that they can be used, and the same remark applies to mounted infantry. Somebody said that the world had for a long time been committing the mistake of trying to make cavalry work on foot. That was not the mistake which has been made; the mistake has been causing cavalry to fire from horseback, a fault which occurred in the war of 1866, among the Prussian cavalry. The firing from horseback and retreating was very annoying to the Austrians, but it was not successful as a tactical manœuvre. And now for the general question of tactics. Drill is of course a part of tactics, and as Lord Chelmsford said, the whole success depends upon the manner in which drill is applied. Colonel Maurice, on the

other hand, has said that the principle to be considered, and it is a great principle, which he thinks that I have not sufficiently noticed, is, that an army is not a machine, as it used to be, and that there must be a great deal more left to individuals. I have already said much on this point, but it will not do to exaggerate the change. The truth seems to me to be between Colonel Maurice's view and that of Lord Chelmsford. No doubt an army is much less of a machine; you must trust a great deal more to junior Officers, and even to non-commissioned officers the leaders of very small forces, but I should be sorry to give up that steady training which alone can put men into the field with confidence in themselves and each other. When you first arrive on a field of battle with an enemy in front of you, that is not the time for you to begin to cudgel your brains with, "What shall I find in the last wars of Napoleon?" or "How was it the Prussians met a case very different to this in 1870?" No; you must have practised these things in time of peace, or you will never succeed in time of war. Men's brains do not work in the same cool way before an enemy that they do in the study. They need to have certain strict rules which would carry them as far as rules can go; but there comes a time when rules can carry them no further, when something is left to each of us, and we must strike out a line of our own. The line which we take will depend upon the accumulation of all the knowledge that we have in us, boiled down in our brain, and we may say also tinged by our own character. One man will be a little more cautious, another man a little more dashing, but each will have to bring out at last what he has learned. And, therefore, the more we have learned, the more we have turned it all over in our heads, the more we have made tactics a part of ourselves, the more readily shall we be able to act in war, when the time comes that each individual's own action is necessary. The tactical forms which are laid down are like the moves of the men in chess. We may make this move, or the other move, and we cannot make more than a certain kind of move with each piece; but we do not stop at learning the moves. How do you learn to be a good chess-player? By perpetual practice, and by studying the best games which have been played by other people. It is exactly the same in war. The whole of peace time we must be at it with companies, with battalions, with brigades, if we have the chance; but at any rate, wherever we are quartered, we should practise tactics with companies, and the smallest possible units. Colonel Hale quoted an article in the "*Revue Militaire*," which I know very well. Permit me to read a rough translation of the conclusion of that article. The writer says: "Beware of going too far, and despoiling attacks of their qualities, their governing virtues, energy and impetuosity. Beware of losing in the imbroglia of methods and expedients, suggested and legitimized in a certain measure by the difficulty of approach, the mother idea which should inspire and inform every decisive action—the conviction, namely, that we are staking our all, and the resolution to carry through the business." In a later article, published on the 30th April, he says: "The essential in the attack is that everybody advances, and advances without ceasing." So he at least is on my side. To sum up, all the forms of tactics come to this at the last, that there you are in front of an enemy with troops which you, according to your good tactical arrangements, have brought up in the best possible manner, the least destroyed by the fire of the enemy. Then comes the moment when there is nothing on earth for you to do but to charge, to do the best you can, and that is clearly stated by this same French writer. He says you have to make a breach first of all, secondly to attack the breach, and thirdly to occupy the breach, and there is no more tactical formation to be laid down for that than there was ever in the days when Frederick's troops and the Russians closed and fought with bayonet and butt at Zorndorf. When all the tactical manœuvres are over, you come to courage, and the *morale* of Officers and men, and to that feeling of confidence which Officers and men must have in each other, or else you had better put your hands in your pockets and make peace.¹

¹ With the permission of the Council, I should like to add a few words on the question of machine-guns in the field. The subject escaped my attention, for the simple reason that on the Continent no nation believes in a future for this class of weapon, nor had I any idea that it could be so seriously regarded by English

The CHAIRMAN: Ladies and gentlemen: I am sure we have all listened with the very greatest possible pleasure and interest, and I may say advantage also, to the lecture we have heard, and to the interesting remarks that have been made upon it. I think every lover of his profession, every lover of the British Army, must be very glad indeed to listen to, or to read, discussions of this nature. Not only is the lecture itself very valuable, but I attach still greater importance to the discussion which takes place after it. It enables every Officer who has thought upon the various subjects touched upon in the lecture to give his views, and by communicating them to others, to make others think upon important subjects like that now under consideration. The subject referred to in this lecture is that, of all others, the most important for our Army and for all the armies in the world. I had hoped to have made some few remarks upon each of the several points touched upon by the lecturer, especially as my friend, Colonel Brackenbury, had supplied me with a list of the subjects which he thought it would be interesting and instructive to call your attention to. But were I to attempt to do this, my remarks would sound like pages extracted from Jomini, for Colonel Brackenbury's list embraces all the heads into which a writer on tactics would naturally divide his subject; in fact, it begins with the use of the three arms, and winds up with "responsibility." I have no intention of going over the whole of those subjects, especially as most of them have been discussed, and, as my friend the lecturer said just now, many of the propositions made by one speaker have been replied to and answered by others. But there are two or three points that I should like to refer to. There has been constant allusion in all that has been said on this subject to the connection between drill and tactics, and there is no doubt whatever that these two subjects are intimately connected. But although with regard to drill it is quite possible to publish a book of regulations, and to lay down very exactly what you should do under all circumstances in a barrack square, or even in the Long Valley at Aldershot in reference to the movements of a brigade or a division, yet it would be utterly impossible for the greatest tactician in the world to attempt to lay down didactically any positive rules with reference to tactics. Before I go any further, I think it is very necessary to tell you that the remarks I am making to you at the present moment, I make not as an official, not as one holding an official position in any way whatever, not as the Adjutant-General of the Army, but as General Wolseley, a comrade of yours, who wishes to tell you what his opinions are. Now, drill has two objects. First of all there is that object to which the lecturer has referred with very great emphasis—I mean "discipline." One of the great objects of drill, as I conceive drill to be, is discipline, for drill disciplines not only the body, but also the mind. The second object that drill aims at is, to enable you to carry out certain manœuvres; in other words, to get at an enemy with as little loss as possible, and as quickly as it is

tacticians. If machine-guns could be transported without difficulty, put down exactly when and where they are wanted, and removed with certainty when no longer required, they would undoubtedly be of great value. But I fail to see how infantry are to move them over the rough ground traversed by foot soldiers; and it appears to me that such pieces would greatly hamper any battalions to which they were attached. And what would become of them in case of repulse? Like the battalion guns of Frederick's time, they would be forgotten in the hurry of retreat, and fall into the hands of the enemy. At short range they would be efficacious; but so is artillery, though it is extremely difficult to persuade Englishmen to believe this truth. At long ranges the difficulty of knowing whether the elevation is correct is greatly against them, and the mitrailleuses failed entirely in the Franco-German campaign for this reason, except when used in defensive positions, as at the battle of Gravelotte. Good shrapnel is more trustworthy, because its effect can be made certain by using compound fuses, that is with both time and percussion action. The addition of light shields to field artillery would, I think, give all the support to infantry that can be desired. The desire to add a new weapon upon wheels is surely an admission that infantry requires something more than its own fire at short range, and is accordingly welcome as a sign. Machine-guns might, however, form part of the army artillery reserve columns.—C. B. B.

possible to do so. This leads me to think of how drill is generally taught, and I cannot help thinking that nearly all the armies of the world, certainly our own, have always reversed the order in which drill should be really taught. We seem, before we begin to lay down rules with regard to drill, or to publish a drill-book, to have conceived for ourselves some floating and curious idea of what war should be, in fact, of what a battle ought to be. Our notions as to what a battle ought to be seem to have come down to us from pre-historic times almost. We then apparently set to work to create a system of drill to meet the circumstances and exigencies of this imaginary battle. My view of drill would be just to reverse that process. I would first of all read the books written by others who have great experience of what has taken place, and what does take place in every action. I would find out exactly what it is—what an action is, from the very first moment a shot is fired until the position on either side is stormed and taken. I would find that out: find out what the duties of a private soldier in action really are, and having thoroughly arrived at that conclusion, then work back from that to the goose step. You have to accept certain difficulties; work back from those difficulties, and try to take the sting out of the disorder which we know to be inevitable, and working back from it, deduce laws from it, and formulate your drill to suit them. Study how you should teach your men, and what you have to teach them; I maintain it is a very great mistake to over-do what you have to teach soldiers. In the present conditions of warfare we have a very great amount of teaching to instil into a soldier to make him a really valuable man in the field; but very often we seem to forget what it is indispensable we should know, and try to teach him complicated movements which are very pretty in Hyde Park, and amusing to the nurse-maids there, but which are of very little use in war. I grant you that these intricate movements tend to discipline the soldier, but I maintain that as nowadays you have only a limited time to teach him in, you ought to devote it exclusively to instruction in useful things; and that in teaching him useful things, you will discipline his mind and body quite as well as if you taught him complicated manœuvres, which are very pretty to look at, but are utterly impracticable in the field. We all know that open order is essential, and we must recognize it as the formation of the future. I think we still cling a great deal too much to close formation. We have too much of the mechanical even in our field-days. There is too much of dressing upon points and going through the different phases of preliminary drill, which I think are useless, and not only useless, but dangerous. I think it is a very dangerous thing to tell a private soldier—who is not a highly-educated man—that when you take him out for a field-day you mean to give him an idea of what an action is like, that you are going to exercise him in a manœuvre that is a fair representation of war; when what you actually do is to drill him in a barrack-yard fashion, and during the course of the day's proceedings to make him do ridiculous things, such as dressing-up and dressing upon points: the result of such a system of instruction is, that when he finds himself actually under fire, and in a difficult position, his head being, perhaps, a little turned by the excitement of the moment, he discovers he is not called upon to do what he was taught in the sham-battle at Aldershot, and the result is a still greater confusion of mind, and a want of confidence in his Officers who had taught him so stupidly, and who by their method of instruction showed their ignorance of the realities of war. I think it is a very dangerous thing to teach a soldier in peace anything which he is not likely to practise during war. Of course you must naturally teach him a certain amount of simple drill to enable him to move with precision, but everything not practical in its objects should, to lead him up to that amount in these days of short service, be ruthlessly eliminated from our drill-books. There has been a great deal said about the mingling of companies, and I am very glad that Sir Beauchamp Walker has said what he has done on that subject. My little experience in war has certainly been mostly in wars with barbarous people, but it has been gained in action with our own troops who are highly disciplined; and I can conscientiously say I have never yet seen our troops go into action, or when called upon to storm a position, or to advance for any length of time under a heavy fire, I have never seen them do so without confusion. I have never seen an instance of any position being assaulted in which companies and battalions were not mixed in a very curious way; the

tatement read by Colonel Maurice in reference to what took place in Egypt was, I can vouch for it, absolutely true. There have been, during the course of our discussion, several references to the subject of the size of our companies. We know it is a point upon which several officers have very decided opinions. Sir Lumley Graham in his very interesting remarks referred to it, and it is one of the few points I would really like to say a little upon, because I know there has been spread abroad throughout the army a sort of idea that because the Germans were successful with large companies, therefore we ought to follow their example. I do not think anybody can accuse me of being a great Conservative in military matters, when I think there is any necessity for change; but when I think of all the mad things to do in this world, it is the wildest to adopt the fighting and administrative formations of another army, simply because that army has been successful. I am sure that even those who, like Sir Lumley Graham, are in favour of these large companies, will bear me out in saying that the origin of these large companies is very easily to be traced. It did not arise from any conviction on the part of the German Officers that large companies were the best formation or the best system of dividing your regiments and battalions. On the contrary, we know perfectly well that large companies have their origin in two facts: first of all in the poverty of Prussia, the actual want of money, the necessity for their being most economical in every way in order to be able to possess a very large army; and, secondly, and this enters very largely into the calculations, the great difficulty of obtaining Officers. As we all know, the Germans do not allow men to become Officers unless they are men of a certain social position; the number of men occupying that social position is limited in every country, and consequently they could not in Prussia or Germany supply the number of Officers that would be required under an organization which compelled them to divide their battalions into eight companies as we do, instead of into four as they do. I have a paper here which has been handed to me since I entered this theatre to-day, which gives an account of the number of Officers wanted in the German Army on a certain recent date. In the greatest of the military newspapers of Germany, it was stated on the 3rd of March, 1880, that there were then in the German Army 10,000 Officers deficient. I do not know what number there is wanting to complete at the present moment, but I have no doubt it has not been very much improved since then. When you think of 10,000 Officers being required to fill up the vacancies then in their army, you may imagine what would be their requirements after the first two or three serious actions of a war, knowing how many they must necessarily lose in an action.

Sir LUMLEY GRAHAM: The 10,000 Officers deficient, I suppose, refers to the war establishment?

The CHAIRMAN: Yes; and of those 10,000 you can always calculate upon 5,000 coming from the retired Officers, but that would leave 5,000 still wanting.

Sir BEAUCHAMP WALKER: The war establishment of Officers differs very little from the peace.

The CHAIRMAN: In 1882, in the "Cologne Gazette" of the 29th of August, it is stated that there were 700 Second Lieutenants deficient, and in one regiment there were twenty-eight wanting. To give you an idea of what their losses were, at Wörth alone one regiment lost thirty Officers, and another forty-six. These figures go to prove that they really have not the Officers to make small companies. But what I especially want to point out on this subject is the faultiness of very large companies from a tactical point of view. Great stress has been laid upon the mixing up in action of companies and battalions, but more especially of companies. If you have to send forward a company to reinforce the actual fighting line, the smaller that company is, the more easily it will be introduced into the fighting line without mixing it up with the companies already there. I follow as well as I can the military writings of the present day, and the impression left on my mind by them is, that the tendency of military thought throughout Europe at the present moment is not in favour of large companies, but tends towards the advocacy of small companies. I find in most of the regulations laid down for the guidance of foreign armies, frequent allusion is made to fighting in groups. What is a group? Nothing more than one of our small companies. Remember the great difficulty in which an Officer is placed when in command of a very large company such as that

to be found in the German army, and which is nothing more nor less than a small battalion, because it is utterly impossible for him to direct or control anything like a company of such proportions. I believe it is utterly impossible for any man in action to lead, control, and give the proper impulse to a company larger than 100 men. I have myself over and over again in action commanded a company of 100 men, and I candidly confess, although my company was very well drilled, before I had been in action two or three hours, I had lost a considerable body of my 100 men: they turned up afterwards, but they had gone off here and there with corporals and sergeants into groups. I had not that power over them which I ought to have had. Had they been fifty or sixty men, I should have had them under my eye; they would have followed me everywhere; but spread out as they were in those days in skirmishing order, it was absolutely impossible to direct or control a company of 100 men. I hope sincerely no love of change will ever induce our authorities for one moment to imitate a system which, as I maintain, was created not for any tactical reasons, but which was called into existence to meet the exigencies of a very poor country, that could only afford to have a large army by reducing, as it did, the proportion of Officers to men, and on account of the impossibility of obtaining the number of Officers required under a system of small companies. I ought to say I am most certainly a believer in long-range firing. I maintain that a battalion of men, or half a battalion, or a quarter of a battalion, drawn up anywhere, firing at 2,000 yards—the range having been calculated—at a place where it is known there is a large force of artillery, will give that artillery a very bad time of it indeed, and the troops drawn up in the neighbourhood of that artillery as supports to it, or as the reserves for the troops already in action, if they came under volleys fired at 2,000 yards, would suffer very severely. I quite agree as to the value of the machine-gun in the field. I believe there is an enormous future for it, for the very reason that it will increase the effect and will aid in the power of long-range infantry volley-firing. The machine-gun will take the place of considerable bodies of men, and when supplied with plenty of ammunition, which it is the duty of those who have charge of an army to provide, I believe there is a very great future for the machine-gun, and that that General or that nation which knows how to develop and make use of it will in the future have a very great opportunity—an opportunity that has never been made use of by any one before. With regard to the artillery, it is rather a difficult subject for me to dwell upon. I am not an artilleryman, and therefore perhaps I may lay myself open to an accusation to which I think the lecturer has laid himself open, namely, “that there is nothing like leather;” for I think he has laid too much stress upon the actual effect of artillery in action. No one has a higher opinion of artillery, and especially of our artillery, than I have. I believe in the virtue of their fire; it is a very disagreeable thing to be under, but I know the very great difficulties that are entailed in order to obtain very good practice in action, and from my experience and from what I have read of the recent actions in the great wars of 1866 and 1870, I confess I do not believe in the great and enormous effects which it is said that artillery fire produces at all times. In the course of his remarks, Colonel Brackenbury has himself, by the statistics he has given us, explained how it comes that the actual losses inflicted by artillery in action are so small. He laid the greatest stress—in fact, the pith of his lecture was to point out the absolute necessity of grappling with your enemy; you must get at him, he said, as soon as possible. We find that the damage inflicted by infantry or artillery fire increases in very rapid proportion the nearer you get to your enemy. We know that in the great battles of recent times, the artillery fire was delivered at ranges of 1,500 and 2,000 yards. Now, according to the statistics that Colonel Brackenbury has read to us regarding the effect of artillery fire, where it must be remembered the guns used were not being fired at at all, and those serving them were well aware of range, yet the number of hits were not so overwhelmingly great at long ranges. Yet it is at these long ranges artillery fire can alone, in my opinion, be delivered, as a rule, in action. To push your guns forward into the infantry fighting line, as some propose, would, with our present long-ranging field pieces, be an act of folly—of course there must always be exceptions to all such rules—if it were practicable, which I do not conceive it to be. If one can attach any importance to the statistics given over and over again by German and French writers as to the losses inflicted

upon the two armies by artillery and infantry fire, we find that the loss by artillery fire was very small indeed compared to that inflicted by the rifled musket. I believe there is a great future for shrapnel. We have never yet seen what artillery can do in the field, because we have never yet had two armies fighting one against the other, each of which had a really effective shrapnel shell; but still I cannot help thinking we shall always obtain from infantry fire a much larger result than we can ever expect from artillery fire. Infantry fire begun at long ranges increases in intensity during an action, because the infantry must advance nearer and nearer on each side, whilst practically the artillery employed will continue to fire at long ranges until one side or other obtains some decisive advantage. I quite agree with what Colonel Brackenbury said about the massing of guns. I know that it is absolutely necessary to do so if you want to make a great effect, especially because I believe the effect of artillery fire to be more moral than physical, and therefore I think the more you mass your guns, the greater that effect will be. With reference to cavalry and mounted infantry, I shall merely say, and I say it with great diffidence in the presence of Sir Beauchamp Walker, that although during the German manoeuvres, at which I was present, two years ago, a considerable force of cavalry was employed, for we had two army corps and a division of cavalry, during the whole of those manoeuvres, I only once saw a squadron dismounted, and when this squadron did act on foot, I must say it did not seem to be a very effective operation. Their cuirassiers were armed with long horse pistols, like what our highwaymen used to carry, and their lancers had a very small proportion of carbines. I remember His Royal Highness the Duke of Cambridge particularly remarking upon that point. You must make the greatest possible distinction between cavalry and mounted infantry. I look upon our cavalry as one of the finest branches of our Army, the best drilled and composed of the best class of our men. It is a most splendid service, and I believe it to be the finest cavalry in the world. Because I think it is so fine, and because we have such a small quantity of it, I should be very sorry to see it turned into bad infantry. I believe it is magnificent for the uses for which it is designed, that is to fight mounted, whilst if the necessity came for them to fight on foot—if they had to seize a bridge or hold temporarily some advanced position—I believe they would do it as well as any other cavalry in the world; but I do not think they would do it as well as infantry. They ought, in my opinion, to have it impressed upon them that their principal *métier* is to fight on horseback, and I hope they will never be converted into bad infantry. With regard to mounted infantry, I believe them to be an absolute necessity with every army; the army that will take the field and go into the field without mounted infantry and with cavalry only—if the German army, magnificent as it is, has ever to encounter an army of equal strength, having with it a large force of mounted infantry—all I can say is, the German cavalry, in my opinion, will have a very bad time of it. Mounted infantry have all the necessary mobility of cavalry, and they have the instruction of the infantry soldier at the same time. I should indeed be very sorry to see any attempt made with our very small Army to convert part of it during peace into mounted infantry. When the time comes we know we can raise a very fair body of mounted infantry. Lord Chelmsford did so in South Africa, and many other Generals have done so before and since, and wherever we have used them we have invariably found them to be of the greatest possible service. I always found the first people to call for their services in action were the cavalry. The cavalry always said, "Where are the mounted infantry?" They did not wish to dismount themselves, and very properly so; they had mounted infantry with them, and the mounted infantry were invented for that purpose. For these reasons I hope we shall not attempt to start any mounted infantry in this country unless the Government would wish to add 5,000 or 10,000 men to the Army, and then I should say by all means so. The last notice on the paper is "Responsibility." I think we shall all recognize the fact that the recent development of tactics vastly increases the responsibility of all junior regimental Officers and non-commissioned officers in action; hence the absolute necessity of teaching them the science and art of their noble profession, in a manner and to a degree never dreamt of in former ages. No one can have a higher opinion of our Officers than I have. I know what they are made of, and I concur in all that has been said as to their merits; indeed, I would go much

further and say, such is my conviction of the desire of the British regimental Officer to learn his profession, that if he is not as thoroughly instructed as he ought to be, the fault will lie not with him, but with men like myself and Sir Beauchamp Walker, with men holding high positions in the Army. All ranks are now most anxious to learn. I have heard for years and years past a cry on all sides from our regimental Officers: "Teach us, give us the opportunity to learn, and we shall show you what we can do." I have now the very agreeable task of, in your name, thanking Colonel Braekenbury for his very instructive lecture; and, might I also add, of thanking those who have been good enough to take part in the subsequent discussion? I am sure we have learned a great deal from what we have heard, and if I might venture to single out any one, I would say how valuable were the remarks that fell from Colonel Hale. The manner in which he comes forward here at all times to give us instruction is worthy of the highest praise.

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OCCASIONAL PAPERS.

This portion of the Number is reserved for Articles, either Original or Compiled, on Professional Subjects connected with Foreign Naval and Military matters; also for Notices of Professional Books, either Foreign or English.

It is requested that communications or books for review may be addressed to Colonel Lonsdale Hale, at the Royal United Service Institution, Whitehall Yard, London, S.W.

THE RUSSIAN ARMY IN 1882.

(Continued from No. CXIX.)

By Colonel SIR LUMLEY GRAHAM, Bart.

PART II.

The Cossacks.

The Cossacks have generally been classed under the head of irregular troops, and justly so until of late years; but now that all Cossack cavalry regiments of the first category are brigaded with the regulars, and are to all intents and purposes regular troops, it seems more appropriate to classify them as such, and to give a description of them in this place, particularly when we reflect upon the importance attached to them by many Russian Officers, who consider them the beau ideal of cavalry.

The Cossacks (*i.e.*, "robbers" or "freebooters") sprang originally from two confederations of military adventurers, who, during the wars between Russia and Poland, took part sometimes with one side, sometimes with the other. One of those confederations was formed on the islands of the lower Dnieper in the 13th and 14th centuries, while the other was established in the marshes of the Don and Volga in the 15th century. The latter body was broken up in 1577, when Ivan IV sent an army against it. Its fractions moved eastward and southward; one band conquering Siberia, another establishing itself at Uralsk, a third occupying Astrakhan, while a fourth made its way into the Caucasus. The Cossack chief, Yermak, having presented Siberia to the Czar, it became part of the Russian dominions, and Cossack colonies were pushed forward along its frontiers. In 1773 revolts having occurred amongst the Don and Volga Cossacks, many of them were transported to the Caucasian frontier, where they colonized the banks of the Terek.

In 1778 the confederation on the Dnieper was finally dissolved, its members being induced to settle on the banks of the Kuban, then the frontier between Russia and Turkey.

These various Cossack colonies, which thus became the pioneers of Russian advance into Asia, were at first independent, but gradually came under Russian subjection and under special conditions of military service, which held good until 1875, and which were substantially as follows:—Every Cossack, with a few exceptions, was bound to serve for a fixed number of years, generally for twenty-two, of which fifteen away from his home, and seven in the Opoltschenié (militia) at home, providing his own horse, arms, and equipment, and receiving pay only when on service away from home.

New regulations came into force on January 1, 1875, being applied at first

only to the Don Cossacks, but being afterwards extended to all the other bands. Under this system the Cossack contingent is divided into two portions—the active portion and the Opoltschenié, the former being subdivided into three classes—the *preparatory*, the *field*, and the *reserve*. The conditions of service in each portion and class are very similar in the various Cossack regions. We will give those which apply to the Cossacks of the Don—the most numerous and important of all. Every youth capable of bearing arms (with certain family exemptions), on attaining the age of eighteen enters the *preparatory class*, in which he remains three years, during the first of which he is not required to perform any military duty, but must provide himself with a horse, equipment, and arms (except the Berdan rifle, half the cost of which is defrayed by the Government, half by the military treasury of the Cossack territory).

During the next two years he is carefully trained, remaining, however, at his native village (*stanitza*). At twenty-one years of age, the young Cossack enters the *field class* for twelve years, divided into three equal periods, during the first of which he serves in one of the four squadrons of Cossacks of the Guard, in one of the twenty regiments of Cossacks of the Line, or in the battery of the Guard, or in one of the seven field batteries, all of which are in the first category of the field class, and are embodied in Divisions of the standing Army. During the next four years, *i.e.*, from the age of twenty-five to twenty-nine, the Cossack belongs to the second category of the *field class*, comprising Regiments Nos. 21—40, and Batteries Nos. 8—14. Officers and men of these regiments remain at home, but must keep their whole equipment, and also their horses, ready for immediate service. For the next four years, that is until they have completed their thirty-second year, the men belong to Regiments Nos. 41—60, and to Batteries Nos. 15—21, forming the third category of the field class. They must keep their equipment in readiness for service, but are not required to provide themselves with horses except on mobilization. When belonging to the second and third categories, they are liable to be called out for three trainings, not exceeding three weeks each. Batteries forming part of the same categories only have four guns horsed in peace-time. Cossacks of superior education enjoy the same privileges as other soldiers in the Russian Army, with regard to reduction of the lengths of service with the colours and to facilities for obtaining the ranks of non-commissioned officer and of Officer. From the *field class* the Cossack passes into the *reserve* for five years, being during this time liable, in time of war, to be drafted into the active Army or into a reserve regiment. After this, that is, after completing his thirty-seventh year, the Cossack is drafted into the Opoltschenié, to which belong also all other able-bodied men who, for one reason or another, have not been embodied in the field class. To this force, which will only be called out under very exceptional circumstances, the Cossack is attached for four years, when, at forty-two years of age, he is exempt from all further liability.

The *Ural Cossacks* are still under the conditions of service which prevailed generally up to 1875, except that the field class is divided, as elsewhere, into three categories; regiments in the first category not being filled up from a roster, like those of the Don Cossacks, but by volunteers from the other categories who receive a bounty, and must serve at least one year before being replaced.

All Cossacks are exempt from poll tax while serving in the field class.

Promotion from the Ranks.—A Cossack must serve from two months to two years, according to his educational attainments, before he becomes eligible for the post of non-commissioned officer (*Urjadnit*). Candidates for an Officer's commission must have served regimentally for from three to eighteen months, according to their educational proficiency, and have afterwards passed directly the prescribed examination at one of the military schools, or at the end of a course of instruction in the same.

Candidates of the lowest educational grade are not allowed to come up for examination under three years' service, of which one as non-commissioned officer; after passing, those who succeed best are at once made Officers, the remainder becoming "Sub-Ensigns" (Podchormeschi), when they rise, as vacancies occur, to the rank of "Ensign" (Chorunschi). Further advancement is regulated as for the Army in general. The Cossack Officer's corps is recruited partly from "Sub-Ensigns" who have gone through the military schools, and some of whom are not Cossacks; partly from men who have performed their term of service in the ranks, and, after being discharged, have rejoined the colours; partly, again, of Officers detached from the regular Army to do duty in Cossack regiments. The standard of education required to qualify non-commissioned officers, after the conclusion of their service, for promotion to the rank of Officers is not very high, being as follows:—a knowledge of the Catechism, of reading, writing, the first four rules of arithmetic, and the principles of outpost duty. Officers drawn from this source are, however, it is said, by no means the worst, and are in the proportion of 28 per cent. of the whole number; some 39 per cent. come from the military schools; 13 per cent. are detached from the regular Army; 14 per cent. men who have served their time and have rejoined after discharge; 1 per cent. civilian officials transferred to the Army; 2 per cent. transferred from other Cossack Corps; and, lastly, 3 per cent. promoted from the ranks for good service.

The number of Cossack Officers transferred to the regular Army is quite as large as that of Officers detached from it to Cossack regiments.

In order to hasten on the improvement in professional training of the present generation of young Officers, all "Sub-Ensigns" are now, immediately after passing their examination, appointed to field-regiments, the best being selected for the Guard; and about twice as many Officers are employed in peace-time with the field regiments as are required for the war establishment. But few of the Generals, commanders of regiments, or other superior Officers come from the regular Army or from the non-Cossack population; for instance, in the Returns of 1879, we find in the Don Cossack contingent 34 Generals out of 36, 317 Field Officers out of 321, and 1,392 other Officers of the higher grades out of 1,425 who were of Cossack origin. On the other hand, but few doctors or Officers of the civil departments are Cossacks. The pay and allowances of Officers in active employ are the same as in the Army at large, and, as with it, considerable additions have been made to their emoluments quite lately, in the form of table allowance and of assistance in the foundation and maintenance of messes. As yet, however, the allowance of a ration for a second horse, which has not long ago been granted to the regular Cavalry and Artillery, has not been extended to the Cossacks.

The Cossack horseman, except those of the Caucasus, is armed with a very long lance or pike, without a bannerole, with the national sabre (schaschka) without a guard, and suspended over the right shoulder, and the Berdan rifle, in a leather case, hanging behind. The Cossacks of the Caucasus have, in addition, pistols and daggers (kinschal). Sergeant-majors and non-combatants are armed with revolvers.¹

The uniform consists of a comfortable blue coat (kaftan), pantaloons with red trimming, high boots, a fur cap, a cloak and cape like that of the Line Cavalry. Round the waist is worn a belt, on which hang two pouches, each containing twenty rounds. Officers of all the regiments, and other ranks of the Guard squadrons, wear spurs; but the other Cossacks carry the native whip (nagaska). Officers wear epaulets, and their badges of rank are the same as in the rest of the Army. In the winter, fur jackets and other warm articles of clothing are worn. The Cossacks of the Guard are more richly

¹ By a decree dated 22nd April, 1883, the rear rank men of Cossack regiments are deprived of their lances. The Lancers and Cuirassiers of the Guard remain as heretofore, but the Hussars of the Guard lose their lances altogether.

dressed, and, indeed, in a similar manner to the remainder of the Guard Cavalry. The horses' equipment differs from that of the other Cavalry, in having a pad attached behind the saddle-tree for carrying necessities, in having the woylach over the saddle, no wallets, and a smaller valise. A chabraque is thrown over everything.

The snaffle, even for Officers, takes the place of the bit. The Cossack's seat is peculiar, high up above his horse, with very short stirrups.

The supply of horses has rather fallen off of late years (though still very considerable), in consequence of the spread of agriculture and of other industries at the expense of horse-breeding, which has resulted in the break-up of many breeding studs, so much so that on certain occasions, when there was a great demand for horses for military purposes, it was difficult to find the right sort of animal; so that measures were taken by the Government to encourage horse-breeding, which have already begun to tell. Thorough-breeds have been introduced and race-meetings started.

In some parts of the Cossack regions the horses are much better than in others, hence a great difference may be remarked as to quality in the remounts of the different regiments according to the locality whence they draw their supply. As a rule, however, the horses of the Steppe maintain their high character for endurance, hardihood, and sureness of foot, in consequence of which the number of purchases made of them for the cavalry and artillery of the Army in general is constantly increasing, and thus the price which the Cossack has to pay for them becomes higher and higher. An Officer receives compensation to the amount of 125 roubles (about 18*l.* 10*s.*), and a non-commissioned officer or private to that of 43 roubles (about 7*l.* 2*s.* 6*d.*), for the loss of a horse.

Cossacks, whilst actually serving, further receive a remount allowance, which also helps to maintain the equipment. Pack-horses are kept up by savings out of the forage allowance.

In consequence of the comparative scarcity of horses, there are at present a good many dismounted men in the Cossack field regiments. In war-time the Cossack helps himself to a remount as best he can; for there are no remount depôts, and consequently a Cossack regiment on active service is apt to melt away rapidly. The poorer Cossacks are assisted out of the public funds of the horde in maintaining horses and equipment. In former days the articles purchased were generally cheap and bad, the arms being of such bad metal as to be of little use, clothing and equipment being often handed down from father to son, and thus not seldom wanting in uniformity. Now things are very different, and one sees Cossack regiments as well got up as any of the Line Cavalry. In December, 1881, the establishment of the Cossack Cavalry was as follows:—

	Officers.	N.-C. Officers.	Musicians.	Cossacks.	Civil officials.	Non-combatants.	Officers' servants.	Troop horses.
The Life Guard Regiment of 6 squadrons, <i>in war</i> ..	53	96	25	960	6	90	65	1176
The combined Life Guard Regiment of 4 squadrons, <i>in peace</i> ..	38	64	25	640	6	61	48	780
A Don regiment of 6 sotnias, <i>in war</i> ..	21	86	19	782	3	65	—	932
Ditto <i>in peace</i> ..	32	56	19	838	3	53	—	923
A Life Guard, Kuban or Terek squadron ..	8	16	4	160	—	18	8	191
A Kuban regiment of 6 sotnias, <i>in war</i> ..	21	56	19	798	2	28	—	992

	Officers.	N.-C. officers.	Musicians.	Cossacks.	Civil officials.	Non-combatants.	Officers' servants.	Troop horses.
A Kuban regiment of 6 sotnias, <i>in peace</i>	42	56	19	798	2	28	—	942
A Terek regiment of 4 sotnias, <i>in war</i>	15	38	13	532	2	21	—	618
Ditto <i>in peace</i>	30	38	13	532	2	21	—	633
An Orenburg regiment of 6 sotnias, <i>in war</i>	21	92	19	784	2	78	—	964
Ditto of 5 sotnias, <i>in peace</i>	30	47	16	706	2	64	—	774
An Ural regiment of 6 sotnias, <i>in war</i>	21	92	19	784	2	78	—	963
Ditto <i>in peace</i>	34	56	19	843	2	71	—	925
A Life Guard Ural squadron, <i>in war</i>	8	17	4	160	—	18	9	195
Ditto <i>in peace</i>	8	17	4	128	—	18	9	159
An Astrakhan regiment of 4 sotnias, <i>in war</i>	15	38	15	532	1	21	—	618
Ditto <i>in peace</i>	30	38	13	532	1	22	—	633

The Training given to the Cossacks, and the Nature of their Duty.

In the olden time the Cossack, being in constant contact with the enemy, was from his very childhood a natural soldier, equally accustomed to fighting on foot and on horseback. In these later days this has ceased to be the case; for the state of warfare now, instead of being constant, is only exceptional. Artificial training has therefore to be substituted for that of his daily life, which was formerly sufficient without any systematic instruction. He receives this now from the State. Whilst still a boy, he learns in his native village the use of arms; he is taught riding, foot drill, and the art of shooting. When he enters the preparatory class, or rather during the last two years' service in it, these exercises are conducted in a thoroughly serviceable manner, the youths being assembled in larger or smaller bodies for fifty-five days annually at certain centres under special instructors. Thus, the young Cossack, when called out to join the "service class," enters it as a thoroughly drilled soldier, often excelling the older men, who not seldom lose somewhat of their military efficiency owing to frequent employment as orderlies or on similar detached duties.

The duties which Cossack troops are required to perform, and the regulations under which they serve, are pretty much the same as with the Army at large. This applies to Infantry and Artillery, as well as to Cavalry. It is true, however, that less uniformity of appearance is insisted upon in the case of Cossack horsemen than in that of the Line Cavalry; also less steadiness and cohesion is necessary, less display of proficiency in the riding-school; but, on the other hand, the Cossack is expected to be more formidable in single combat, a better rider across country, more skilful as a partisan on outpost and reconnoitring duty than his comrade in the regulars, whilst he is at the same time his equal in fighting on foot.

But, as we have before remarked, since the Cossack regiments of the first category have been embodied in the Cavalry Divisions, these distinctions have become less marked, and bid fair to disappear in time, each description of troops borrowing more and more from its sister corps. Already the term "irregular" is no longer applicable to Cossack regiments of the first category; and as regiments of the second and third categories are mainly composed of men who have served in the first category, the same may also be said of the latter corps. The Cossack hordes, however, which are domiciled more to the East have preserved their "irregular" characteristics to a greater extent: for instance, the Cossacks of the Ural retain a form of substitution, which the

Government would be glad to do away with, but has not as yet judged it expedient to do so.

The principal tactical peculiarity of the Cossacks is the so-called "lawa," a modified form of the attack "en fourageurs," as practised by the regulars. It is carried out as follows :—A sotnia will extend to two and a half times its own breadth when in line, forming rank entire ; at fifty paces in rear is a small support, composed of a few horsemen, to serve as a rallying-point after the charge. The "lawa" is intended to surprise the enemy by rapidity of movement, and to outflank him. An entire regiment may form two "lawas," with three "sotnias" extended in first line, two extended in second line écheloned on the flanks, and the sixth sotnia following in close order, as a reserve.

Cossack regiments labour under one very serious disadvantage, which must greatly detract from their efficiency in war, and that is the small establishment of Officers ; for, besides its Captain, the sotnia has on its strength only two Officers, of whom one is generally detached ; so that in case of casualties there is frequently only one, sometimes not a single Officer, present with it. And this defect is all the more felt because the nature of the service for which Cossacks are particularly adapted requires frequent small detachments to be made. The establishment, too, of fourteen files per section is too small for war ; and it is seriously contemplated to organize the regiment in four sotnias, instead of six, retaining the same total number of combatants.¹ In this manner the efficiency of the sotnia and of the section will be increased. Another defect in organization is the small number of surgeons and hospital attendants, as well as of tradesmen, owing to which latter want clothing and equipment go to the bad very much on service.

The regimental transport of Cossack troops is chiefly composed of pack-animals. Each Don regiment used to have 32 horses in peace time and 75 in war, including those for draught ; but when the order for reduction of the military budget was issued, December 29, 1881, the peace establishment was cut down to 21. This reduction, though certainly an economy, will be productive of some difficulty whenever it becomes necessary to mobilize, as a greater number of horses will then be required to complete the establishment. There is a feeling amongst the Cossacks that it would be well to substitute wheel transport for pack transport, and there cannot be a doubt that they are right with regard to regular operations carried on in countries well provided with roads, though, for the rapid raids which Cossack cavalry may be expected to execute, what little baggage it may be absolutely necessary to take will probably be best transported on very lightly loaded pack-animals.

Resources, in point of Men and Horses, available in the Cossack Territories.

A table appears in the "Armed Strength of Russia," giving an estimate of the male population of the different Cossack regions, and of the number of horses in the same available for all purposes.

The estimates were made at different periods for the different regions—the earliest in 1867, the latest in 1877, the most important (that concerning the Don Cossacks) in 1875. The total male population is put at 966,323 ; the total number of horses at 1,193,317 ; the male population in the Don territory at 376,092, and the number of horses at 419,589.

There is every reason to believe that the entire number of males may now be safely reckoned as considerably over 1,000,000, and that of the Don Cossack males at 400,000. As for the horses, it is probable that, for reasons previously given, their number has not largely, if at all, increased.

Now, we find that over 61,000 men are required for the different regiments

¹ It will be curious if this is carried out just as the rest of the cavalry is upon the point of adopting the present Cossack organization in six squadrons.

and batteries comprising the Don contingent when on a war footing, and this includes the infantry (all local corps for home service and in small numbers). The cavalry alone amount to about 50,000 men. It is estimated that, over and above the number of soldiers thus required for the field army, there remain in reserve some 90,000 trained men fit for service.

In the year 1856, at the end of the Crimean war, the male population of the Don territory was only 272,437; there were at that time 71,772 Don Cossacks in the ranks.

In July, 1878, under the new system, with a male population of over 380,000, the Don territory furnished 47,957 soldiers, all of the 1st category. The mobilization of regiments in the 2nd and 3rd categories was effected with fair expedition, and without encountering any serious difficulty. The regiments of the 2nd category were called out on April 3, 1877, and were entrained on May 1st; those of the 3rd category were summoned on April 17, 1878, and commenced their entrainment on May 3rd. The machinery for mobilization has since that time been greatly improved, to which improvement the railway and electric telegraph largely contribute. It is thought, therefore, that all the forty regiments of the 2nd and 3rd categories may be mobilized under three weeks; twenty more reserve regiments might be raised, and be ready for service within four weeks at latest, assuming that the expense of horsing them were defrayed out of the very rich military chest of the territory, an expense which would not swallow up more than 38 per cent. of its capital. At the same time, it cannot be denied that such an expenditure of force would cripple the territory for a long time, for the conditions of military service fall harder upon the Cossacks than upon the other subjects of the Empire.

Seventeen Don Cossacks per 1,000 are enrolled annually in peace time, against 4·8 per 1,000 in the Empire generally, whilst in war the proportion is 245 in Cossackia to 57 elsewhere. Again, including his marches to and fro, the Cossack serves fully as long as other soldiers. Then he has to spend at least 23*l.* on his outfit, which he has afterwards to keep up, in addition to finding his own horse, and keeping it for four years after completing his service with the colours, without being able to make much use of it for his own purposes. The loss of time, too, is of consequence to him when called out for the summer drills and such like. The Cossack has an advantage over other Russian subjects in paying lower taxes; but it is calculated that, even making this into consideration, he is mulcted for State purposes to the amount of 2*l.* 12*s.* a year during his twenty years of service, whilst his fellow-countrymen are only taxed to the amount of about 1*l.* 3*s.* a head per annum; moreover, if the Don territory were subject to the ordinary law of conscription, it would supply a yearly contingent of only 1,500 recruits, instead of the 6,112 now enrolled. The Don Cossack, however, fortunately looks upon himself as a privileged man, in consequence of these hard terms of service, and would not exchange them willingly for those in force elsewhere. It is therefore allowable to suppose that Russian optimists, who maintain that Don Cossackia will need furnish 100 regiments, and even more, for the defence of the Empire, are not as imaginative as may at first sight appear.

With regard to the smaller Cossack hordes, no assistance whatever is to be expected from those of Asia towards carrying on an European war, whilst from those of the Ural, Orenberg, and the Caucasus the supply of warriors would be very uncertain, depending, as it would, upon the demands made upon those hordes for the defence of their own homes, and being, moreover, much impeded by the distances to be traversed and by the deficiency of communications. The last war furnishes us with fair data for forming an estimate upon this point. The Kuban and Terek hordes placed in the field the whole of the tactical bodies which they were bound to organize; the Orenbergers turned out 77 per cent. of their establishment; and the only difficulty as to

mobilization occurred in the Kuban territory. Out of 8,900 men of the 3rd category only 5,318 could mount themselves, so that the remainder were necessarily employed as infantry. In the Terek region, on the contrary, the regiments of both 2nd and 3rd category were formed without any trouble, 1,227 men remaining, moreover, as a reserve. All the three Astrakhan regiments were embodied. They were, however, short of Officers, who were detached to them from the Don contingent. The first ten cavalry regiments of the Kuban horde were ready in ten days; the next five in fifteen days. Mobilization in Uralia took more time than elsewhere in consequence of the defective telegraphic communication. But this will be remedied ere long, and so will also the insufficiency of railroads; and then, even if each of the minor hordes has to employ half its force at home or in Asia, the remainder, amounting to 200 sotnias and from 40 to 50 guns, will, according to a great authority on Cossack matters, Mr. Choroschin, be available for service on any theatre of war whatever. When we add this force to that furnished according to regulation by the Don territory, namely 372 squadrons or sotnias and 132 guns, and again unite with it the Baschkirs, Crim-Tartars, and other foreign elements, we arrive at a grand total of 600 sotnias of Cossack horsemen, supported by from 170 to 180 guns. But this is not all. Suppose that, in a time of great national danger, the whole effective force of Cossackia were called into the field, a host would be mustered consisting of 768 sotnias of cavalry, besides 30 of infantry and 222 guns; that is to say, of nearly 138,000 combatants of all ranks.

If, again, we add to this vast host the Asiatic irregulars, we raise our grand total to nearly 166,000 of all ranks.

The proportion of Cossacks in the different arms, taking the whole army for comparison, is 1 per cent. in the Infantry, 70 per cent. in the Cavalry, and 60 per cent. in the Horse Artillery. We remarked before upon the large percentage of soldiers furnished annually by the Cossack contingent. Large as this is, however, it has been reduced by nearly one-half during the last twenty-five years, as the following figures will show:—In 1856, with a male population of 722,793, 218 per 1,000, or over 21 per cent., were enrolled; whilst at the present time (1882), with a male population of 1,069,954, only 146 per 1,000, or 14·6 per cent., are liable for service at the same time. On the 1st January, 1881, only one-third of the fixed establishment, and 4·8 per cent. of the whole male Cossack population, was under arms. In the course of one year the total population of the Cossack region had increased by 84,660 souls, whilst the number of men liable for service had been augmented by 16,894, or 1·7 per cent. We cannot doubt, after studying these figures, that the Cossack hordes constitute an almost inexhaustible supply of horsemen for the Russian army. Having disposed of the question of *quantity*, what is to be said of the *quality* of these troops? Upon this question there is a very great difference of opinion amongst Russian Officers. One school extols the Cossack to the skies, cannot speak too highly of his warlike qualities—of his quickness, endurance, tractability, natural intelligence, &c.—looks upon him as the model to be set up for imitation by all mounted soldiers; in a word, wishes to Cossackize the regular cavalry. This is one extreme. Another school consists of admirers of regular cavalry after the orthodox pattern, and speaks of the Cossack in terms of the greatest depreciation. According to these gentlemen, the Cossack is insubordinate, undisciplined, unreliable, lazy, wanting in solidity, even more afraid of firearms than he ought to be. Unless regularly trained and led, he is only fit for such inferior work as escort or orderly duty, forays on defenceless villages, foraging, and the pursuit of a demoralized enemy. Those who hold these views wish to regularize the Cossacks, just as those of the other extreme school wish to Cossackize the regulars. Truth lies doubtless, as usual, between the two. The Cossacks, excepting those of the Caucasus, have long ceased to have the opportunity which their forefathers

enjoyed of gaining warlike experience by their daily life ; this must therefore be replaced, as far as may be, by instruction as it is. On the other hand, regular Russian cavalry has been remarkable for its heaviness, and for the want of sympathy between man and horse ; so that it is natural that the ardent spirits who dream of emulating the deeds of Jackson and Stewart should place but little confidence in troops so manifestly unfit to carry out their views, and should turn their eyes with hope to the countless Cossack hordes.

We have stated the extreme views held by two parties in Russia upon their value in war. Of course the shades of opinion between those two are many and various. Before quitting the subject, we may recall to our memory the estimation in which the Cossacks were held by their opponents in actual warfare. This will, perhaps, be even a better guide to us than the opinions of their friends and countrymen.

The Cossack was not well known in Western Europe till the campaign of 1812. His reputation was then established, and, although he has not done much to raise it since the termination of the Napoleonic era, the impression which he then made has never been effaced from the imaginations of the inhabitants of the countries in which he appeared either as friend or foe. He was doubtless unpleasant in either capacity. We have only to deal with him from the latter point of view. It is sufficient to read Napoleon's despatches and orders, and the numerous military memoirs of the day, to be convinced of the great effect produced by the rapid movements and constant desultory attacks of the Cossack horsemen, even during the advance on Moscow. During the halt and subsequent retreat, the Cossack was ubiquitous. No straggler had a chance, and in the demoralized state of the French army the terror inspired by these savage horsemen was extreme. The fame of their deeds spread westward as they advanced, and had its effect upon the new French levies. We find Napoleon constantly complaining of the mischief done by what he calls "this contemptible cavalry, which only makes a noise, and would be unable to break a company of infantry." And this, though perhaps a somewhat exaggerated statement, does not seem to have been very far from the truth. The Cossack, dangerous as he was against a disorganized or demoralized enemy, never appears to have gained great credit as a combatant. Probably the Cossack of the present day is not very unlike his ancestors in this respect ; but we doubt not that, however this may be, the presence of Cossack cavalry will make itself unmistakably felt in the next great war in which Russia is engaged.¹

The Cossack Department at Head-quarters.

The general administration and command of the Cossack troops rests with the above-named Department, which appertains to the War Ministry. The present heir to the throne, the Grand Duke Nicholas, is the "Ataman" or Head of the Department and Chief of the Cossacks. Under this Department are the commissions of the different Cossack territories whose Atamans have similar powers, though somewhat more restricted, to those exercised by the General Governors of Military Districts or the Military Governors of the Asiatic Provinces. In the Don Cossack territory, the most important by far, the administrative arrangements bear, of all, the closest resemblance to those in force generally throughout the Empire.

The "Nakasny-Ataman" gives his directions, with regard to military

¹ We may, perhaps, be doing scant justice to the warlike qualities of the Cossack of the present day, and we recommend our readers to peruse some most interesting articles in Nos. 507 and 508 of the "Revue Militaire de l'Étranger," headed "Notes d'un Cosaques," which gives a translation of a paper by Lieutenant-General Ivan Andrianow, in the "Vaianyi-Sbornik." This officer commanded a brigade, and afterwards a Division of Don Cossacks during the late war, and speaks very highly of their conduct.

matters, through his Staff, at the head of which is an Officer with the same powers as those of the District Chiefs of the Staff; with regard to civil matters, through the Commission of the territory over which he presides. The territory is divided into five districts for administrative purposes, each of which is under a district Ataman with his Staff. This Officer communicates his orders through the head men of villages and the councils, to which is the last appeal both in military and civil cases, and which regulate all executive details with reference to enrolment, training, and mobilization. A certain number of units are stationed in each district, and, as a rule, each village has to furnish and keep up its own contingent. On mobilization, the number of men called out is divided as equally as may be amongst the different villages.

In war time, the field "Ataman" of the Cossack troops present with the Army occupies the same position as the Commanding Engineer or the Officer commanding the Artillery. The "Nakasny-Atamans" of the minor territories occupy a position analogous to that of the Ataman of the Don Cossacks, only with less independence: for instance, those of Kuban and Terek are under the Viceroy of the Caucasus; whilst those of Orenberg and of the Ural are under the General Governor of Orenberg. Universal liability for military service is the rule throughout all the Cossack territories, where it is even more stringently enforced than in the remainder of the Empire. Each contingent has its own military chest, which is replenished by means of contributions drawn from the population, and especially from those exempted from service. Its funds are applied towards the general expenses of the contingent, and towards aiding the poorer members of the community in fitting themselves out.

Artillery.

The Artillery of the field Army is divided into "Field" and "Horse" Artillery.

The field artillery is made up of heavy, light, and mountain batteries, six of which, constituting a brigade, are attached to each of the 48 Infantry Divisions, including the Guard, the Grenadiers, and the Army of the Caucasus, but exclusive of the Asiatic Divisions. Each battery has 4 guns horsed in peace time, and 8 in war; thus there are 288 batteries, with a full complement of 2,304 guns. There are, besides, two brigades in Turkestan and one in Eastern Siberia, with an independent battery in Western Siberia. These Asiatic brigades have, however, a smaller number of batteries than usual. The brigades bear the same numbers as the Divisions to which they are attached, and three of them are also named after their honorary commanders, members of the Imperial family. The batteries in each brigade are numbered consecutively, the heavy having the lowest, and the mountain (where any) the highest, numbers. The calibre of the guns is as follows:—
A. Heavy, 4·2 in.; B. Light, 3·42 in.; C. Mountain, 2·5 in.

A. Two batteries to each Division of the Guard and of the Grenadiers, to the Caucasus Grenadiers, and to Divisions 1—41 of the Line; one battery to the first Turkestan Division.

B. Four batteries to each of the Guard and Grenadier Divisions, to Line Divisions 1—18, to 22—37, and to 40; two batteries to Line Divisions 19—21, to 38 and 39, to 41, also to the two Turkestan and to the Siberian Divisions.

C. Two batteries to Line Divisions 19—21, to 38 and 39, to 41, also to the two Turkestan and to the Siberian Divisions. Thus, when on a war footing, the Russian Field Artillery turns out 790 heavy guns, 1,488 light guns, and 120 mountain guns; or a total of 2,392 field pieces, including the three Asiatic Divisions.

A field battery is divided, for tactical purposes, into two half batteries, each of which forms two divisions, each of two guns.

There are three recognized establishments to a battery.

1. The peace establishment, with detachments for four divisions, but horses for only four guns and for no ammunition-wagons.

2. The increased establishment, with horses for four ammunition-wagons and one spare gun-carriage, besides four spare horses.

3. The war establishment, when all the guns and wagons are fully horsed, and gun detachments are provided for four field divisions. There are six horses in each gun or wagon team, both in heavy and light batteries. There are sixteen ammunition wagons per heavy and twelve per light battery. Both guns and wagons have poles, and the teams are harnessed in pairs, with a driver for each pair, except in the case of the store wagon, when the horses are four abreast and driven from the box.

PEACE ESTABLISHMENT OF A HEAVY BATTERY OF FIELD ARTILLERY.

Combatants.

Officers.

Battery Commander (Colonel or Lieutenant-Colonel)	1
Half-battery Commanders (1 Captain, 1 Staff-Captain)	2
Subalterns (1 Lieutenant, 1 Sub-Lieutenant, 1 Ensign)	3
Total Officers	6

Non-commissioned Officers and Men.

Sergeant-major....	1
Quartermaster-sergeants	3
Sergeants in charge of divisions	4
Bombardiers	8
Trumpeters	3
Acting bombardiers	46
Gunners and drivers	136

Total non-commissioned officers and men 201

Total all ranks 207

War establishment—Officers 6
Non-commissioned officers and men 236

Total 242

The addition to the peace strength is made up as follows :—

5 extra bombardiers,
10 „ acting bombardiers,
20 „ gunners and drivers.

—
35 total addition.

The establishment of a light field-battery is the same as that of a heavy battery, except with regard to acting bombardiers and gunners ; there being, of the former, 41 in peace and 46 in war ; of the latter, 106 in peace and 134 in war. The peace establishment of a light field-battery is thus 172 of all ranks ; and the war establishment, 210 of all ranks.

PEACE ESTABLISHMENT OF A MOUNTAIN BATTERY.

Combatants.

Officers.

Commanding battery (Colonel or Lieutenant-Colonel)	1
Commanders of half-batteries (Captains or Staff-Captains)	2
Subalterns	3
Total Officers	6

Non-commissioned Officers and Men.

Sergeant-major....	1
Sergeants in charge of divisions	4
Bombardiers	8
Trumpeters	4
Acting bombardiers	30
Gunners and drivers	80

Total non-commissioned officers and men 127

Total all ranks 133

The war establishment of Officers is the same. On the war establishment there are—

4 extra sergeants.
8 „ bombardiers.
8 „ acting bombardiers.
105 „ gunners.

125 total extra.

The war establishment of the mountain battery is, therefore—

Officers	6
Non-commissioned officers and men	252
Total all ranks	258

PEACE ESTABLISHMENT OF A HORSE ARTILLERY BATTERY.¹*Combatants.*

	Officers.
Commander of battery (Colonel or Lieut.-Colonel)....	1
Captain or Staff-Captain	1
Subalterns	3

Total Officers 5

Non-commissioned Officers and Men.

Sergeant-major	1
Quartermaster-sergeants	3
Sergeants in charge of divisions	3
Bombardiers	7
Trumpeters	3
Acting bombardiers	28
Gunners and drivers	117

Total non-commissioned officers and men 176

Total all ranks 181

The war establishment only differs from the peace establishment by the addition of three bombardiers and one acting bombardier, making a total of all ranks of 185.

The Horse Artillery battery has 6 guns horsed, both in peace and war ; but

¹ It is understood that there will soon be a great augmentation to the Horse Artillery either by increasing the strength of batteries or by adding to their number. The augmentation will be made by degrees in the same manner as in the Cavalry.

only 2 wagons in peace and 9 in war. It is formed in three divisions. Its gun is of the same calibre as that of the light field battery, but it is shorter and lighter than the latter. The ammunition is the same for both guns. The horse artillery battery has, like the field artillery, an "increased establishment," intermediate between those of peace and war, under which the number of horses is increased by 11.

Non-combatants.

The heavy and light field batteries have each the same number of non-combatants (including clerks, hospital attendants, farriers, artificers, and drivers), that is to say, 13 in peace and 24 in war.

A mountain battery has 29 non-combatants in peace and 108 in war.

The horse artillery battery has 15 non-combatants in peace and 26 in war.

Horses.

The *heavy field battery* has, on the peace establishment, 5 Officers' horses, 12 troop horses, 27 draught horses, and 6 horses for the artillery train; on the war establishment, 5 officers' horses, 18 troop horses, 163 draught horses, 14 horses for the artillery train, and an uncertain number of baggage animals. Peace establishment, 50 horses; war establishment, 200 horses, besides baggage animals.

The *light field battery* has the same establishments, except that it has only 137 draught horses in war, or altogether 174 horses, besides baggage animals.

The *mountain battery* has in peace 5 Officers' horses, 22 draught horses, 6 train horses—total 33; and in war 5 Officers' horses, 135 draught horses, and 66 baggage animals: total 206.

The *horse artillery battery* has in peace 4 Officers' horses, 106 troop horses, 53 draught horses, 6 train horses—total 169; and in war 4 Officers' horses, 107 troop horses, 103 draught horses, 16 train horses, and an uncertain number of baggage animals: total, without baggage animals, 230.

The artillery brigade attached to each Infantry Division is under command of a Major-General, who is, of course, under the orders and the disciplinary control of the Lieut.-General commanding the Division; but he is also responsible for all matters relating to the special arm, as are the commanders of horse artillery batteries attached to Cavalry Divisions to the commander of the artillery of the Army Corps to which the Division belongs. Should the artillery brigade or the batteries not belong to any Army Corps, their commanders are then responsible for artillery matters to the district artillery commandant. In like manner the Officer commanding the Army Corps artillery, though under the immediate command of the General commanding the Army Corps, is also responsible to the Officer commanding the artillery of the Army, if in the field, or to the district artillery commandant, if on home service. The last-named Officer is on the staff of the General commanding the military district, of which there are in Russia 14.

The Commander-in-Chief of the Russian artillery is now the Grand Duke Michael Nicolayewitsch, who is at the head of the artillery department in the Ministry of War.

The artillery belonging to the Russian field army amounts, on the war establishment, to—

	Guns.
Field artillery, attached to infantry divisions	2,392
Horse artillery, attached to cavalry divisions, including	
Don Cossack batteries	240
Horse artillery in Asia (10 batteries)	60
Don Cossack batteries 8—21, only mobilized in war	84
Total	2,776

If we compare the proportion of artillery to other arms now existing in the Russian Army with that maintained in the German Army, we find in the former 48 field guns per Infantry Division of sixteen battalions, or 16,000 men, *i.e.*, 3 guns per 1,000 men; whilst in the latter we see an Army Corps of two Infantry Divisions (24,000 men) supplied with 96 field guns, over and above the horse artillery, *i.e.*, 4 guns per 1,000 men. On the other hand, the Russian Cavalry Division of sixteen squadrons, with 12 guns, is just as well off for artillery as the German Cavalry Division of twenty-four squadrons, with 18 guns. According to report, however, it is intended ere long to raise the field artillery brigades to the strength of eight batteries, in which case the proportion of field guns to infantry will be the same as in Germany, and it is probable that then also the German custom of permanently separating the corps artillery from the Divisional artillery will be introduced.

The materials of which the *personnel* of the artillery is composed are very good, recruits being selected for it of superior physique and intelligence as far as possible; also those who can read and write, and who have learnt a trade, such as that of smith or carpenter. The horses also are very good, particularly those for draught. The price given for those of the Guard Artillery is about 31%, and for those of the other artillery about 20%. Stallions are not taken; and mares only in the proportion of one-third. The regulations as to remounts and casting are almost identical with those in force with the Cavalry; there is, however, only one remount dépôt for both Horse and Field Artillery in each military district, except in those of Petersburg and of the Caucasus, where there are two. At each of these dépôts there is one Officer, with some assistants, and from 17 to 110 men, according to the number of batteries stationed in the district.

The clothing and equipment of the Field and Garrison Artillery are exactly like those of the Infantry, except that the Guard Artillery wear black velvet collars, and the Line Artillery collars of the same colour as that of the tunic, with red braid. The gunners have the infantry knapsack; but the drivers have the valise. The gunners of field and garrison batteries are armed with a short sabre, hanging to a shoulder-belt; and in war time they all carry the Berdan rifle, though in time of peace only one-fifth of the field battery gunners are thus armed.

Trumpeters, drivers, sergeant-majors, and sergeants carry revolvers as well as the sabre.

As this sabre is inconvenient to the gunners when serving the gun, there is an idea of substituting for it, in their case, a shorter side-arm.

Horse artillerymen are clothed and equipped like Dragoons. All Artillery Officers wear the red sash round the waist. The arms are the same for Horse Artillery as for the field batteries, except that the gunners in the former all carry revolvers. The horse-equipment of all Artillery resembles that of the Cavalry.

In Russia, it is believed that the Field Artillery is equal to that of any other Power, and the Horse Artillery superior to all others, on account, say they, of the excellence of the horses, the lightness of the *matériel*, and the perfection of the training.

Dismounted men of the artillery park are armed with rifles and bayonets.

A field battery carries the following entrenching tools:—16 picks, 16 hatchets, 4 shovels, and 4 crowbars. A mountain battery has 16 shovels, 16 axes, 16 mattocks, 16 picks, and 4 crowbars.

Artillery Matériel.

All field guns are of steel, composed of a wrought tube and a cast jacket. A great many of those now in the service were made by Krupp (pattern 1877), and are almost identical with the German guns (pattern 1873). The

remainder (pattern 1879) were made at the Obukov works, differing from those of Krupp chiefly in the jacket, which is continued right up to the muzzle. The breech-closing apparatus in both is the Krupp cylindro-prismatic wedge. All guns are fitted with the Broadwell ring. The grooves are of uniform size throughout, the twist of the rifling being progressive. The sight is telescopic, similar to that in use in Austria. The guns are coated with black varnish. The old field guns, with which reserve and dépôt brigades are at present supplied, are bronze 9 and 4 pounders, of the same calibre as the new steel guns, the breech-closing apparatus being the old flat Krupp wedge.

The horse batteries, both regular and Cossack of Europe and the Caucasus, are armed with the new steel 4-pounder; but some of the other Cossack batteries have the old bronze 4-pounder, carrying the same ammunition as the new guns. The mountain gun is at present of bronze, with a calibre of 2·5 inches, but it will be probably superseded by the Baranowski gun, which is of the same calibre, but of steel; its breech mechanism is like that of the Berdan rifle, and its charge is contained in a metallic cartridge.

RUSSIAN FIELD GUNS.

Pattern 1877.

	Heavy Field.	Light Field.	Horse Artillery.	Mountain.
Metal....	Steel	Steel	Steel	Bronze
Calibre	4·2 in. cwt. qr. 12 1	3·42 ins. cwt. qrs. lbs. 9 0 3	3·42 ins. cwt. qrs. lbs. 7 0 11	2·5 ins.
Weight				
Length of bore to base of powder-chamber	17·1 calibres	16·9 calibres	15·5 calibres	
Total length of bore....	19·7 calibres	23·7 calibres	21·4 calibres	
Number of grooves	24	24	24	12
Twist in calibres	1 in 36	1 in 40	1 in 36	
CHARGES.				
Weight	4 lbs. 1 oz.	2 lbs. 15·8 ozs.	2 lbs. 15·8 ozs.	
Proportion of charge to projectile	$\frac{1}{7}$	$\frac{1}{4\cdot9}$	$\frac{1}{4\cdot9}$	
Initial velocity	1,200 feet	1,450 feet	1,350 feet	
Rotatory speed....	95	127	132	
PROJECTILES.				
Weight of loaded shell	27 lbs. 8·6 ozs.	15 lbs. 2 ozs.	15 lbs. 2 ozs.	
Length of shell in calibres	2·6	2·6	2·6	
Weight of bursting charge	14·4 ozs.	7·2 ozs.	7·2 ozs.	
Weight of shrapnel shell ...	27 lbs. 8·6 ozs.	15 lbs. 2 ozs.	15 lbs. 2 ozs.	
Weight of bursting charge	3·8 ozs.	2·2 ozs.	2·2 ozs.	
Number of balls in shrapnel shell	300	190	190	
Metal of balls	Lead	and anti-mony.		
Weight of balls....	0·42 ozs.	0·42 oz.	0·42 oz.	
Weight of case shot....	27 lbs. 1·4 ozs.	16 lbs. 0·5 oz.	16 lbs. 0·5 oz.	
Number of balls in case shot	171	76	76	
Metal of balls	—	Zinc.	—	
Weight of balls....	1·73 ozs.	2·24 ozs.	2·24 ozs.	

	Distances.	Elevation.	Angle of Descent.	Remaining Velocity.	Probable Variation.	
					Lateral.	Vertical.
	Mètres.	° "	° "	Mètres.	Mètres.	Mètres.
Heavy Field Gun	500	1 7	1 9	343		
	1,000	2 18	2 36	315.90		
	2,000	5 35	6 52	268		
	3,000	9 49	13 16	230.30		
	4,000	15 37	22 3	205.60		
	5,000	22 54	33 8	193.90		
	5,300	25 50	37 30	104.90		
Light Field Gun	500	0 26	0 45	396.90	0.10	0.10
	1,000	1 21	1 44	360.20	0.20	0.30
	2,000	4 2	4 54	301.60	0.63	1
	3,000	7 30	9 39	258	1.50	2.25
	4,000	11.24	15.44	227.60	2.50	4.60
	5,000	13 28	19 18	217.10	3	6.75
	6,000	20 16	32 6	205.80	4.48	19.30
Horse Artillery Gun	6,400	22 15	35 14	205	4.80	24.25
	500	0 39	1 14	374	0.15	0.15
	1,000	1 40	2 42	341	0.40	0.42
	2,000	4 29	6 34	288	1.10	1.28
	3,000	8 9	11 33	245.5	2.50	3.12
	4,000	12 42	17 43	218.5	4.70	6.67
	5,000	17 48	25 25	204.5	8.70	13.15
	6,000	23 20	34 36	201.3	16.40	24
	6,400	25 48	38 40	200.9	19.10	30.20

The powder supplied to the Russian field batteries is composed of 75 parts of saltpetre, 10 of sulphur, and 15 of charcoal. The grain is coarse.

With the exception of case, all projectiles are furnished with two copper rings. The shell is of the kind called annular segment, similar to that in use in the Austrian service for the Uchatius guns, and to the German shell (pattern 1876). In the shrapnel, the bursting charge is in the base of the shell, being separated from the balls by an iron diaphragm. There are now two kinds of shrapnel in use; that approved of, and to be eventually the only one, consisting of an ogival head, connected with the cylindrical part by screws. The case shot is a zinc cylinder, with sheet-iron ends. Both time and percussion fuzes are used; they are both made of metal. In the former, the fuze composition is carried inside the body of the fuze, and the fuze is graduated outside, being ignited by a detonating arrangement. The new pattern fuze burns for 12 seconds.¹ The percussion fuze is on the Prussian

¹ The following remarks are contributed by an experienced Officer:—"There is little difference between the Italian, Austrian, and Russian time-fuzes, all of which are better than the English, in that the composition burns more evenly. The superiority is not so much in the composition as in the system of covering the circular groove containing it with a thin felt, which ensures an even pressure.

principle, with a safety pin, which is ejected by the rotatory motion of the projectile on leaving the muzzle.

The present field gun carriage is built entirely of steel and iron, with wooden wheels. The diameter of the latter is 4' 6" 7", and the width of track 5' 5". The carriages of the field and horse artillery gun are precisely similar, except that the latter has no axletree seats, and carries four instead of two rounds of ammunition in the boxes. The elevating apparatus is that known as the Russian double screw; it consists of an inner right-handed screw working in an outer left-handed screw, the latter working in a gun-metal socket. The trail is so shaped as to plunge into the soil and thus check the recoil. The strain on the gun is reduced by gutta-percha buffers. The limber-boxes, wagon-bodies, and axletree seats also ride on gutta-percha springs. Each projectile in the limber and wagon boxes is carried in a separate compartment, and the cartridges are packed in leather bags placed in leather cases. The carriage of the mountain gun is of similar construction, except that the elevating-screw is single and works in a gun-metal screw-bed. A pair of shafts can be attached to the trail for draught.

The new iron ammunition wagon consists of a body and limber. Many of the old two-wheeled carts, drawn by three horses abreast, have been converted into wagon bodies by replacing the pole by a perch, and the old cart wheels by limber wheels. All the batteries during the last war, except those of the Guard, had carts, three per gun in heavy and two per gun in light batteries.

At present sixteen ammunition wagons belong to each heavy field battery in war time, twelve to each light, and nine to each horse battery. There are six horses to each gun and wagon in war; but in peace time light guns and a certain number of wagons are drawn by four horses. The weight of a heavy field-gun ammunition wagon is 46 cwt. 3 qrs. 4 lbs.; of a light field-gun wagon, 46 cwt. 0 qr. 8 lbs.; and of a horse artillery wagon 34 cwt. 1 qr., 4 lbs. The gun limbers and ammunition wagons, with their limbers, contain as follows:—

For heavy field gun	....	57	shells,	63	shrapnel,	6	case, of which in
Gun limber	....	7	"	9	"	2	"
For light field gun	....	77	"	82	"	5	" of which in
Gun limber	....	13	"	15	"	2	"
For horse artillery gun	61	"	60	"	9	"	of which in
Gun limber	....	7	"	10	"	3	"

The store wagon has a hood of waterproof canvas, and is provided with a driver's seat.

The new Russian artillery *matériel* is painted dark green; the old, of which there is still a good deal in use, light green.

Ranges of Russian Field Guns.

The most effective ranges for shell and shrapnel with the new guns are between 1,200 and 2,800 yards. Shell fire is not supposed to be employed over 7,000 yards; nor shrapnel fire, with time fuzes, over 3,500 yards. The most effective ranges for the latter species of projectiles are between 1,200 and 2,400 yards, the results being very great against swarms of skirmishers or against bodies of troops, whether exposed or under cover, when, on account of the nature of the ground, the fire of shells with percussion fuzes is inapplicable.

Every time-fuze is made to act as a percussion-fuze at need, so that every shell explodes. The Russians are trying an improvement on the safety-pin principle. The tumbler or hammer is retained in its place by a weak worm to a screw which gives way when the flight of the projectile is arrested. For heavy shells this system answers admirably."

Case shot is used against an enemy at close quarters (from 250 to 300 yards), generally to repel an attack on the battery. If there is no case at hand, shrapnel is substituted with time fuzes set for $\frac{1}{3}$ of a second, so that the shell may burst about 120 yards from the gun. When a battery first unlimbers it is only supposed to fire one round per gun per minute, but after the range has been found it should keep up the fire at the rate of three rounds per minute.

Recruits appointed to the field batteries are not taught to ride during the first six months; after which the drivers, who are selected from amongst the best men, are instructed in that art, using the snaffle, and are also taught to drive, to harness and unharness, to saddle and pack, and to look after their horses. During the first six months they go through a progressive course of instruction of gymnastics and of foot drill; they are made acquainted with the details of all the *matériel* which they will have to use; they are taught gun drill, sword exercise, &c. In the matter of school work, they are only expected at first to learn how to read and write figures so as to be able to use the range tables. With horse artillery the case is different. The young soldier is taught from the first to ride and to use the sword; in other matters his progress is pretty much the same as with the field-battery man. His riding-school drill is exactly the same as that of the cavalry soldier, and includes the use of the revolver. He has so much to learn that he cannot get through it all, even with the greatest application. As it is, his training as a gunner is rather in arrears.

Instruction is given, as in the other arms, by some of the older soldiers previously selected and trained for the purpose under the personal guidance of an Officer, and under the superintendence of the battery commander. The Division Officers are responsible for interior economy.

The training of the artillerymen in gun-practice is very complete, and systematic, both in theory and practice. Every gunner is required to know how to lay a gun, although a certain number of men in each battery are specially told off for that duty with special privileges.

Skill in target-practice is, however, a good deal impaired by the scarcity of good ranges, in consequence of which each battery has to hurry through its course so as to make room for another; and the field firing especially must needs be carried out in a very unreal sort of way, on account of the want of space and of the intimate acquaintance which every one has with the ground. Such being the case, we should beware what construction we put upon the performance of the batteries, which must, under the circumstances, be very delusive. Russian authorities are fully alive to these shortcomings, and the tendency is to make both small and large tactical bodies, after going through their course of drill, pursue their training in such a manner, both in evolutions and in firing, as to make each exercise a real tactical manoeuvre, first of all with blank ammunition, afterwards with ball cartridge, varying the ground as much as possible. According to regulation, 246 rounds are allowed annually to each battery for practice, including 128 shell, 108 shrapnel, and 10 case shot.

The following abstract of the report upon the gun-practice carried out in May and June, 1881, on the range at Kijew is instructive:—

Four brigades of field artillery and four batteries of horse artillery were engaged at the same time, that is a total of twenty-eight batteries, or 128 guns, each of the field batteries only turning out four guns.

Each gun fired two loaded shell, two loaded shrapnel, and two case shot as *preliminary practice*, the principal object of which is to make the young soldier acquainted with the properties of the gun and of the different projectiles. The field-firing practice was divided into six exercises, three of which with shell and three with shrapnel. Four of these exercises were devoted specially to firing on earthworks.

One exercise was given up to firing at moving and disappearing targets, in which the great accuracy of the new gun showed itself. The exercises were closed, as they always are, by an inspection on the part of the General commanding the military district, on which occasion an extra allowance of 16 shell and 16 shrapnel per battery is sanctioned. Only a certain number of the batteries present could take part in the gun-practice at this inspection, for want of time. On this occasion a tactical idea was worked out. The targets represented two chains of skirmishers with reserves, three four-gun batteries, and two parties of cavalry, each target being 9 feet high and 60 feet long, one behind another at a distance of 30 paces. Each battery was provided with 35 shell and 24 shrapnel; 8 shell being allowed for finding the range, distances being unknown. There were three separate heats, two batteries being engaged in each. In the first heat, the firing was with shrapnel against a chain of skirmishers, a field battery getting the range (2,100 yards) at the sixth shot. The average of hits was sixteen to every shot. This result is, in Russian official language, "more than very good." A horse battery, which fired on the same mark, got the range at the fifth shot; but its practice was recorded only as "more than middling," as it put in but $5\frac{1}{2}$ hits per shot. Russian horse artillery, be it remarked, is generally inferior in gun-practice to field artillery. In the second heat, the mark was a battery; the projectile shell. A heavy battery got the range at the ninth shot, and at 2,473 yards made 400 hits—more than 16 hits per shot; a result described as "more than very good." A light field battery got the range also in nine shots, and at the distance of 2,520 yards made 21 hits per shot, receiving equally high praise. In the third heat, a horse battery fired on artillery with shell, finding the range (1,540 yards) at the seventh shot; 509 hits, or 21 per shot.

A Don Cossack battery fired with shrapnel, range 1,490 yards; hits, 1,136, or 47 per shot.

In the last two cases the verdict was, as in all the former but one, "more than very good."

The seven Cossack batteries of the first category, be it remarked, are in every way as well turned out and trained as the "regular" artillery, to which they yield in nothing. The Don batteries of the other categories also keep four guns constantly horsed, and go through an annual course of training which lasts several weeks.

After the field-firing came the prize shooting, in which the "leading gunners" (No. 1) competed. This was followed by the prize driving. About 4l. 19s. per battery is allowed annually for these two competitions.

Field-firing is carried on in the same manner on the other ranges, special attention being everywhere paid to shrapnel fire, which is much valued in Russia.

The Drill and Tactics of Artillery.

The battery is, as everywhere else, the smallest tactical unit. The field battery has eight guns in war; four guns in peace. The horse battery has at all times six guns. The eight-gun battery is divided into half-batteries, each under its special commander. Each pair of guns, commencing from the right, form a division under an Officer. A mounted non-commissioned officer has special charge of each gun. Six men compose the detachment for a light field gun, and seven men for a heavy field gun. Nine men are allotted to each horse artillery gun, of whom three are horse-keepers. Gun drill is pretty much the same as elsewhere.

Each wagon has a non-commissioned officer in charge, two gunners, and three drivers. When the gun is unlimbered, the limber is kept twenty paces behind it, with the horses' heads towards the enemy. When the battery is in action, non-commissioned officers in charge of guns are posted with the limber, immediately in front of the leading pair of horses.

When the gun is limbered up, the gun detachment falls in, according to circumstances, either on one or on both sides of the gun. The recognized rates of speed are, for field guns, 125 paces in the minute at the walk, 300 at the trot. The gallop is only allowed exceptionally with field guns; but with horse artillery it is one of the recognized paces, the rate being 600 paces per minute.

When rapid movement is continued for any length of time the gunners are seated, two on the gun-carriage, three on the limber, the remainder on the wagons. The battery may be formed in line, or may break into column from either flank or from the centre, either by single guns (sub-divisions) by divisions, or by half-batteries. When a battery is in line, the interval between guns is 27 paces, or 12, or 6.

The battery commander posts himself 25 paces in front of the centre; the half-battery leaders 10 paces in front of their respective half-batteries; the third and fourth Officers 4 paces in front of the flank divisions; the fifth Officer with the wagons; sergeant-major in rear of the line. When the battery consists of only four or of six guns, the senior subalterns lead divisions, and the third or fourth Officer goes to the wagons. When in action, the commander is 8 paces in rear of the line, half-battery leaders 4 paces, and division leaders 2 paces.

Columns are either open or close, *i.e.*, with 6 paces distance. Officers are posted in the first case as in line, in the second case on the pivot flank. All movements and firings are executed at the word of the half-battery and division leaders, after the battery commander has given the caution; but the guns are not put in motion until the commander gives a signal with his sword. When the battery is in line, the centre directs; when in column, it moves by the right, unless otherwise ordered. Non-commissioned officers in charge of guns are responsible for pace and direction, drivers having only to follow them, and looking straight to their front, except in marching past, when they glance to the right on passing the saluting point. Column formations and deployments are generally on the centre. When the battery is in action, the commander sheaths his sword, and goes wherever his presence is required. The other Officers may dismount to regulate the firing. Non-commissioned officers in charge of guns, drivers, and horse-keepers also dismount.

The rules for loading and firing, either by salvoes or by successive guns or divisions, appear to be the same as with us.

The battery, when in action, is to change its position as seldom as possible—a rule which appears to be recognized in all armies. When a change of position is necessary, the battery commander rides on with his trumpeter and places himself where the centre of his battery will be. Non-commissioned officers in charge, in the case of field-guns, No. 6 in the case of horse artillery, gallop out and act as markers, dismounting till the battery approaches. The battery may also advance or retire in *échelon* of half-batteries. In executing such movements, as well as all others under fire, field batteries move at a trot, with gunners seated; but horse artillery may, if it be advisable, gallop. The movement may be covered by the fire of the halted *échelon*.

Ammunition wagons remain 50 paces in rear of the battery when in line, and form, when manœuvring, a separate *échelon*, composed of two divisions, each of two wagons under an Officer, whose duty it is to conform to the movements of the battery, keeping as near to it as prudent when advancing, and always before it when retiring, and in taking ground to a flank moving as far as possible on a level with the centre guns. Sometimes, when the fire is very rapid, it becomes necessary to take wagons up to the very gun-limbers.

The second *échelon* of wagons, which has to feed the first *échelon*, not only with ammunition but also with men and horses, follows the battery at a distance of from 1,200 to 1,500 paces, and completes itself from the corresponding section of the “flying park,” which, when an action is impending,

naturally approaches as close as possible, but at other times remains usually one or two marches in rear of the army. This "flying park" carries 108 rounds for each heavy and 116 for each light field gun, whilst the "field parks" follow two or three marches further to the rear, conveying 36 or 43 rounds per gun (according to calibre). Again, three or four marches further back are the main dépôts, with 250 rounds per gun.

The total provision of gun ammunition is therefore as follows :—

For heavy field guns	....	....	....	520 rounds per gun.
For light field guns	....	....	....	573 "
For horse artillery guns	....	....	....	539 "

The Movements of a Combined Force of several Batteries.

When two or more batteries are in line deployed, they preserve an interval of 30 paces.

When in line of battery columns, these must always be close columns, though the intervals between the batteries may be more or less full.

A line of contiguous battery columns is formed with intervals of 30 paces between the batteries when these are in columns of half-batteries, with intervals of 80 paces when the batteries are in columns of divisions, the columns being in each case close, but with full interval between guns. When all the batteries form one general column, whether of half-batteries, divisions, or subdivisions, the distances may vary at pleasure between "close" and "open," but if the column is of batteries, it is always a close column. When the column is of half-batteries, the full distance between batteries is 80 paces; when of divisions or subdivisions, 30 paces; in close column the distance is always 20 paces. Ammunition wagons are, as a rule, behind all the batteries when in close column, and on the flank of their own battery when in open column. The commander of the whole line posts himself with his staff and trumpeter 100 paces in front, or, if in action, in rear, and when taking ground to a flank, opposite the centre, at 100 paces distance. When in action, he of course is at liberty to go where most required. A line of several batteries marches by its centre, unless otherwise ordered. The evolutions of many batteries in combination are much practised, in view of the necessity of massing artillery in action now generally recognized.

The Action of Artillery in Combination with the other Arms.

The German principle is acted upon, of keeping a considerable force of artillery well to the front in column of route as well as in order of battle, so that it may serve to cover the deployment of the other arms from the very commencement of the action. In all cases, however, a portion of the guns will be held in reserve for use at critical moments. Artillery once in action will be relieved only under very exceptional circumstances, and then only together with the other troops in position. A battery will not even be withdrawn if it has fired away all its ammunition. The commander of a body of artillery, small or great, when acting with other troops, as will generally be the case, should not be hampered by minute instructions from the Officer commanding the whole force, but should only receive general directions, which he should have considerable latitude in carrying out.

We may here remark that the question of how far independence of action is permissible to an artillery Officer has for some time, and still is, hotly discussed by Russian military writers. The question has by no means been decided, even by the authoritative enunciation of the principle just stated. The action of Russian artillery in the last war was by no means always

satisfactory—a fact which was made use of both by those who wish to give artillery greater freedom of action, and by those who, on the contrary, desire to limit this freedom, each party in support of its own views; the artillerymen complaining that the commanders under whom they served were too often unacquainted with the powers and peculiarities of artillery, dispersing it too much and preventing its effective action; Infantry Officers, on the other hand, maintaining that even in peace time the “gunners” are inclined to look upon themselves as a privileged caste, with greater knowledge than their comrades of the other arms, which feeling leads them in war to aim at emancipating themselves from the control of superior Officers not belonging to their own branch of the Service—a tendency all the more hurtful because the Artillery Officer is, say these objectors, as a rule, too much occupied with the merely technical points of his duties to make himself well acquainted with the tactics of the three arms. The latter party, which is not confined to Infantry Officers, but includes some noted artillerymen, proposes, in accordance with the views just expressed, that artillery, instead of being, as now, under the Divisional or Army-Corps commanders merely for purposes of discipline, whilst under the superior Officers of its own arm for all technical matters, should in future be placed entirely under the General commanding the Division, who would have on his staff an Artillery Officer as adviser. The more moderate section of the other party takes an exactly opposite view with regard to the position of artillery in peace time, and claims for it a degree of independence equal to that accorded to the Engineers, admitting, however, the necessity of its subordination to higher authority in war. The extremists go a long way further, and claim for the arm entire independence of action both in peace and war, as by such alone, say they, can you arrive at the combined action of batteries in large masses, after the modern fashion, at the right moment without undue wear and tear of *matériel*.

It seems probable that the present system, that of the divided command of artillery in peace time, while in war the whole control remains with the Officer commanding the body of troops, of which the artillery form part, will be maintained.¹ The new regulations upon the training of the Army will moreover give both artillery and infantry much greater opportunity of becoming acquainted with the tactics of each other's arm and of working in unison.

There seems to be less difficulty with regard to the relations between cavalry and horse artillery than with regard to those between field batteries and infantry.

Garrison Artillery.

It is intended to form eventually fifty garrison artillery battalions for serving the siege guns in the fifteen European fortresses and in Alexandropol (Caucasus). Each battalion will consist of four companies, with a total establishment of 1,200 men in war and of 400 men in peace. As yet, however, only forty-one battalions have been organized, six of which have as yet only three companies. The following table gives in Column I the name of each fortress supplied with garrison artillery; Column II gives the number of battalions now existing in each place; Column III the number contemplated:

¹ Since the above was written we have learned from the “Revue Militaire de l'Étranger,” No. 565, that the divided command of artillery, even in peace-time, no longer exists, the field batteries forming part of army corps being placed entirely under the General Officer commanding the corps.

I.	II.	III.
Kronstadt	6	6
Wyborg	2	3
Sweaborg	2	2
Dünamünde	1	1
Dünaburg	4	4
Bobruysk	1	1
Warsaw	2	3
Novogeorgiewsk....	5	7
Brest-Litowsk	3	4
Ivangorod	2	3
Kijew	3	4
Nicholajewsk	3	3
Bender	1	1
Kertch	3	5
Alexandropol	3	3
Total	41	50

In addition to these battalions, eleven garrison artillery companies are maintained, two of which are at St. Petersburg, and the remainder at various posts in Asia. Garrison artillery matters are under a special committee in every fortress. The gunners are armed with rifles, and go through the whole of the infantry drill and instruction, including rifle practice. There is target practice with siege guns, and special manœuvres, especially siege operations, take place annually for the instruction of the garrison artillery. There is a special programme for the training of Officers, both in winter and in summer, calculated so as to extend their knowledge of the attack and defence of fortresses.

The "Revue Militaire," No. 567, states that the Artillery Committee of Alexandropol is to be removed to Kars, and that one of the battalions of artillery now in the former fortress on the war footing is to be converted into three battalions on the peace footing, the five battalions thus formed out of the three now existing being divided between Alexandropol and Kars, with dépôts at Michailovsk on the Caspian and at Poti; these measures to take effect from 13th January, 1883.

SIEGE GUNS, GUNS OF POSITION, AND GUNS FOR COAST DEFENCES.

RIFLED GUNS.

Breech-loaders.

Cast-steel hooped guns for coast defence (14", 11", 9", 8", 6·03", and 6"); light 8" steel-hooped guns; 30-pr. cast-iron guns; long 24-pr. steel, bronze, and cast-iron guns; light 24-pr.; light 12-pr.

Muzzle-loaders.

24-pr. steel and cast iron; 12-pr. steel, bronze, and cast iron; 12-pr. and 9-pr. field guns (pattern 1861).

RIFLED MORTARS.

Breech-loaders.

Cast-steel hooped mortar for coast defence (11" and 9"); 8" cast-steel hooped mortar; 8" bronze and cast-iron mortar; 6" bronze mortar.

Muzzle-loaders.

6" mortar, bronze.

SMOOTH-BORE GUNS.

10·75" cast-iron shell guns; 60-pr. cast-iron guns; 69-pr. cast-iron carronades; 36-pr. cast-iron carronades; 24-pr. cast-iron carronades; long 7·07" cast-iron howitzers; light 7·07" cast-iron howitzers; 6·02" cast-iron howitzers.

RIFLED GUNS. (From "Armed Strength.")

	11-in. steel	9-in. steel.	8-in. steel.	Light 8-in. steel. Pattern 1873.	6-in. steel. Coast defence.	Long steel 24-pr.	Light bronze 24-pr. Pattern 1872.	12-pr. cast-iron. Pattern 1867.
	T. cwt. qr.	T. cwt. qr. lb.	T. cwt. qr. lb.	T. cwt. qr. lb.	T. cwt. qr. lb.	T. cwt. qr. lb.	T. cwt. qr. lb.	T. cwt. qr. lb.
Weight of Gun, including breech-pin	27 11 1	14 10 1 16	8 16 0 21	5 16 2 25	4 3 3 13	3 1 1 2	1 8 1 16	1 9 0 2
Weight of segment shell	562 lb.	276 lb.	179 lb.	—	96 lb.	—	—	—
Weight of common shell (loaded) ..	494 "	280 "	172 "	172 lb.	81 "	64 lb.	64 lb.	32.5 lb.
" shrapnel shell (loaded) ..	—	—	—	—	—	79 "	79 "	37 "
Greatest powder charge	82.7 lb.	46.3 lb.	30 lb.	19.4 lb.	18.1 lb.	19.9 "	6.2 "	2.3 "
Initial velocity of common shell	1,286'	1,339'	1,385'	1,024'	1,342'	1,575'	1,063'	879'
Penetration of iron plates at 1,000 mètres	9.5 "	6.5 "	4.9 "	—	4.3 "	—	—	—

RIFLED MORTARS.

	11-in. steel.	9-in. steel.	8-in. steel. Pattern 1870.	6-in. bronze. Pattern 1867.
	T. cwt. qr. lb.	T. cwt. qr. lb.	T. cwt. qr. lb.	T. cwt. qr. lb.
Weight of Gun, including breech-pin	10 5 1 10	4 19 2 16	3 2 0 27	1 10 3 24
Weight of common shell, loaded....	494 lb.	280 lb.	172 lb.	81 lb.
Greatest powder charge	—	—	14.4 "	5.4 "
Initial velocity of common shell	—	—	797'	722'

SMOOTH-BORE MORTARS.

13·02" cast-iron mortars ; 9·23" cast-iron mortars ; 6·02" bronze mortars ; 4-pr. bronze mortars ; 3-pr. bronze mortars.

Machine Guns.

The old Gatlings last used by Russians in the field against the Tekhé Turcomans in 1881 are now to be kept solely for the defence of ditches. They have ten barrels, and fire the Berdan ammunition. Palm Krantz mitrailleuses have also been lately adopted : that for land service (fortress) fires from 800 to 1,400 rounds a minute ; that for sea service has a larger calibre, and can fire up to 3,000 rounds a minute.

Screw Guns.

A screw siege gun and mortar have been introduced. The former has a calibre of 8", and the latter of 9". Forty of these have been ordered, with 100 rounds per gun.

Wall Pieces.

The Krinka wall piece has a calibre of '797". It fires a ball weighing 4 oz. 2 drs., and the powder charge is 4·44 drs. ; initial velocity, 1,408' ; weight of piece, 45 lbs.

Siege Artillery.

Siege guns are worked by detachments from the garrison artillery. There are three siege trains, including that belonging to the army of the Caucasus. Each train is divided into twelve sections, except that of the Caucasus, which is composed of ten. The siege train consists chiefly of hooped guns, weighing 4 tons, with an initial velocity of about 1,500' ; of short bronze pieces of two tons weight, with an initial velocity of 700' ; of bronze guns of 15 cwt. ; of 8-inch rifled steel mortars, weighing four tons ; of 6-inch rifled bronze mortars ; and of 20-pr. smooth-bore bronze mortars, in the following proportion :—Of the 4-ton guns, 50 per cent. ; of the 15-cwt. guns, 20 per cent. ; and of the remainder, 30 per cent.

Field Parks and Ammunition Depôts.

The field artillery parks serve in war to keep up the supply of ammunition for the troops, and are kept both during peace and war divided into two branches—one to supply ammunition to infantry and field artillery, the other to do the same for cavalry, horse artillery, and rifle battalions. The parks are again distinguished as "flying" and "mobile." There is one of the former for each Division, subdivided into three artillery sections and two infantry sections, with 130 four-wheeled wagons. These form the first line. The second line of wagons, which feeds the first, consists of the "mobile" parks, thirteen in number, each of four sections. There are twenty-one sections of the "flying" park, each with twenty-four 4-horse wagons, for the use of the cavalry ; and seven of the same, each of sixteen wagons, for that of the rifle battalions. In time of peace, these cavalry and rifle sections are amalgamated, and the cadres are maintained, whilst neither men nor horses are kept for the other parks, the material being in store and ready for use.

A *siege park* contains, according to regulation, besides all the other material, 400 guns ; but this number may be increased or diminished, according to the requirements. Six battalions of garrison artillery are allotted to a park. The three siege parks are always kept complete in point of *matériel*, but not in point of *personnel*, during peace only a sufficient number of Officers and men being attached to them to keep everything in good order.

The *advanced artillery depôt* of the Army serves to keep the different artillery units complete in men, horses, and *matériel*, ammunition excepted. Its strength depends upon circumstances.

The *ordnance magazines* supply the field parks of the Army.

The *provisional magazines of small arms* are intended for the safe keeping and repair of small arms, which are stored at certain points until an opportunity offers for despatching them to the front.

The *movable artillery and laboratory establishments* serve for such repairs of the *matériel* connected with fire-arms as cannot be executed by the regimental artificers.

Technical Establishments for Artillery Purposes.

There are three *manufactories of small arms*—at Tula, at Ischewsk, and at Sestroretzk.

A *cartridge-factory* at Petersburg, where all parts of the cartridge are made except the powder.

Three *powder-factories*—at Ochta, Michailowsk-Schostensk, and Kasan.

Arsenals at Petersburg, Brjansk, Perm¹, and Kijew, for the repair of bronze guns, carriages, limbers, wagons, &c.

A *rocket-factory* in the Chersonese.

An *arsenal and laboratory* in Turkestan.

A *cartridge-case factory* at Moscow.

District arsenals, with laboratories, in the different military districts (in some, indeed, more than one) for storage and maintenance of artillery *matériel*, small arms, and ammunition.

Artillery ranges in eight of the military districts for gun-practice, for training Officers and non-commissioned officers, and for carrying on experiments. The principal of these stations is at Ochta, where there is a special arsenal, and a detachment of 150 men who are employed in experimentalizing on all matters connected with artillery *matériel*, under special superintendence of the President of the Artillery Committee.

A *pyrotechnical school*.

A *technical school*.

The technical schools-of-arms at Tula and at Ischewsk for the training of artillery sergeant-majors, draughtsmen, &c.

*Engineers.*²

The Engineers are formed in five brigades, four of which belong to European Russia and one to the Caucasus. In each of the European brigades there are three sapper battalions, one railway battalion, two half-battalions of pontoniers, one field-engineer train, and two telegraph trains. The second and third brigades are, in addition, supplied with an engineer siege train. The Engineer Brigade of the Caucasus has only three sapper battalions, one field engineer train, and one telegraph train. In peace time, every sapper

¹ All field guns, and also 6" guns, are made at Perm, and at the Oboukoff works at St. Petersburg. 11" guns are also made at the latter, and indeed at Perm also, but many made at the latter place have failed from the metal being too brittle.

² Since the above was printed a considerable augmentation has been made to the Engineers, together with some changes in organization. There are now (July, 1883) five brigades in Europe and one in the Caucasus; the former consisting each of three battalions of sappers, two pontoon half-battalions (except the first and fifth brigades, which will each have only one), one railway battalion, three field telegraph trains with 195 versts of wire, and one field engineer train. The second and third brigades have also, as before, each an engineer siege train. There are besides altogether four companies of miners and one galvanic company. The Caucasian brigade consists of two battalions of sappers, one telegraph train, and one field engineer train. In time of war there will be an addition of thirty reserve companies of sappers and four dépôt battalions in Europe, and of four reserve companies in the Caucasus.

attalion has five companies, one of which becomes the *depôt* on mobilization. The field sapper battalion has thus only four companies. The pontonier half-battalion has only two companies. The railway battalions consist of four companies—two for constructing, and two for working railways. The field engineer train conveys entrenching tools and other necessities for field-fortification. It consists of three sections, each of which is divided into four divisions. Each pontoon train carries materials for the construction of a ridge 700 feet in length.

The *engineer siege train* conveys all the requisites for siege operations. It is divided into four sections, each complete in itself, with all engineer materials necessary for the siege of a fortress. In peace time, all tools and other stores are held in readiness; also a baggage train, consisting of twenty-four wagons and four field forges. Horses are not kept in peace time. Each engineer siege train has a so-called Park Company attached to it.

The *field telegraph train* is maintained for the purpose of establishing telegraphic communication between the several portions of an Army, and between each of these and head-quarters. Each train carries the materials for establishing a telegraph line 195 versts (130 miles) in length, with implements for six stations. The train is provided in war time with 6 station wagons, for apparatus, batteries, &c.; 3 wagons for provisions; 21 six-horse wagons for carrying materials, with accommodation for fourteen men each; 3 four-horse wagons, for reserve material and accommodation for ten men each. There are twelve spare horses.

Establishment of a Sapper Field Battalion.

OFFICERS.

Peace.				War.			
Colonel as Commandant	....	....	1	Colonel as Commandant	....	....	1
Lieutenant-Colonel	....	....	1	Lieutenant-Colonel	....	....	1
Captains	....	....	2	Captains	....	....	2
Staff Captains	....	....	2	Staff Captains	....	....	2
Subalterns	....	....	14	Subalterns	....	....	11
Total	....	....	20	Total	....	....	17

NON-COMMISSIONED OFFICERS AND MEN.

Sergeant-Majors	....	....	5	Sergeant-Majors	....	....	4
Quartermaster-Sergeants	....	....	7	Quartermaster-Sergeants	....	....	6
Sergeants	....	....	21	Sergeants	....	....	17
Corporals	....	....	40	Corporals	....	....	58
Drummers	....	....	11	Drummers	....	....	9
Bugler	....	....	1	Bugler	....	....	1
Lance-Corporals	....	....	80	Lance-Corporals	....	....	80
Privates	....	....	520	Privates	....	....	780
Volunteers	....	....	10	Volunteers	....	....	8
Total	....	....	695	Total	....	....	963
Grand Total Combatants	....	....	715	Grand Total Combatants	....	....	980
Administrative Officials	....	....	3	Administrative Officials	....	....	3
Workmen, Drivers, &c.	....	....	35	Workmen, Drivers, &c.	....	....	50
Horses	....	....	16	Horses	....	....	98

Establishment of a Pontoon Half-Battalion.

OFFICERS.

Peace.	War.
Commandant (Colonel) 1	Commandant (Colonel) 1
Captain (for administration) 1	Captain (for administration) 1
Adjutant (Captain) 1	Adjutant (Captain) 1
Paymaster, Quartermaster, and Arms Officer (Subaltern) 1	Paymaster, Quartermaster, and Arms Officer (Subaltern) 1
Captains Commanding Companies 2	Captains Commanding Companies 2
Subalterns 6	Subalterns 6
Total Officers 12	Total Officers 12

NON-COMMISSIONED OFFICERS AND MEN.

Battalion Quartermaster Sergeants 2	Battalion Quartermaster Sergeants 2
Company Sergeant-Majors 2	Company Sergeant-Majors 2
„ Quartermaster - Sergeants 2	„ Quartermaster - Sergeants 2
N.-C. Officers (1st Class, Sergeants) 8	N.-C. Officers (1st Class, Sergeants) 8
N.-C. Officers (2nd Class, Corporals) 16	N.-C. Officers (2nd Class, Corporals) 22
Volunteers 4	Volunteers 4
Battalion Trumpeter (Mounted) 1	Battalion Trumpeter (Mounted) 1
Drummers 4	Drummers 4
Lance-Corporals 32	Lance-Corporals 32
Privates 230	Privates 300
Total N.-C. Officers and Men 301	Total N.-C. Officers and Men 387

Non-Combatants.

OFFICERS.

Junior Surgeon 1	Junior Surgeon 1
Veterinary Surgeon 0	Veterinary Surgeon 1
Accountant 1	Accountant 1

NON-COMMISSIONED OFFICERS AND MEN.

Clerks 5	Clerks 5
Hospital Sergeants 4	Hospital Sergeants 4
„ Pupils 2	„ Pupils 0
Farrier Sergeants 0	Farrier Sergeants 2
Hospital Orderlies 2	Hospital Orderlies 2
Master Armourer 1	Master Armourer 1
Tradesmen and Artificers 11	Tradesmen and Artificers 20
Cutter-out 1	Cutter-out 1
For the Baggage Train— 1 N.-C. Officer, 2 privates 4	For the Baggage Train— 1 N.-C. Officer, 9 privates 10
For the Pontoon Train— Sergeant-Majors 0	For the Pontoon Train— Sergeant-Majors 4
Sergeants 0	Sergeants 8
Lance-Corporals 0	Lance-Corporals 16
Privates 0	Privates 116

Total Non-Combatants.

	Peace.	War.
Officers	2	3
Non-commissioned Officers and Men	30	185

Establishment of a Railway Battalion.

Officers.			Non-commissioned Officers and Men.		
Commandant (Colonel) ....	...	1	Battalion Staff ....	...	4
Battalion Staff ....	...	7	Company N.-C. Officers ....	...	80
Commanders of Companies ....	...	4	Volunteers ....	...	8
Subalterns ....	...	12	Lance-Corporals ....	...	80
			Drummers, &c. ....	...	10
			Privates ....	...	820
Total Officers			24	Total N.-C. Officers and Men 1,002	

Non-Combatants.

Officers.			Non-commissioned Officers and Men.		
Battalion Staff ....	...	3	Battalion Staff ....	...	43

Establishment of a Field Telegraph Train.

Peace.			War.		
Commandant (Lieut.-Col.) ....	...	1	Commandant (Lieut.-Col.) ....	...	1
Captains ....	...	3	Captains ....	...	3
Lieutenant (including the Adjutant) ....	...	1	Lieutenants (including the Adjutant) ....	...	2
Sub-Lieutenants ....	...	2	Sub-Lieutenants ....	...	2
Sergeant-Major ....	...	1	Sergeant-Major ....	...	1
Telegraphists ....	...	24	Telegraphists ....	...	24
Mechanicians ....	...	6	Mechanicians ....	...	6
N.-C. Officers (1st Class, Sergeants) ....	...	0	N.-C. Officers (1st Class, Sergeants) ....	...	12
N.-C. Officer (2nd Class, Corporal) ....	...	1	N.-C. Officers (2nd Class, Corporals) ....	...	24
Lance-Corporals ....	...	3	Lance-Corporals ....	...	36
Privates ....	...	40	Privates ....	...	191
Total			82	Total 302	

Establishment of a Field Engineer Train.

Peace.			War.		
Commandant (Lieut.-Col.) ....	...	1	Commandant (Lieut.-Col.) ....	...	1
Officers ....	...	3	Officers ....	...	7
Non-commissioned Officers ....	...	5	Non-commissioned Officers ....	...	17
Lance-Corporals ....	...	6	Lance-Corporals ....	...	8
Privates ....	...	42	Privates ....	...	97
Non-Combatants ....	...	6	Non-Combatants ....	...	140
Total			63	Total 270	
Horses ....	...	0	Horses ....	...	280

Establishment of a Siege Engineer Train.

Peace.				War.			
Commandant (Field Officer)	....	1		Commandant (Field Officer)	....	1	
Other Officers	....	1		Other Officers	....	11	
Non-commissioned Officers	....	2		Non-commissioned Officers	....	20	
Drummers	....	0		Drummers	....	4	
Lance-Corporals	....	0		Lance-Corporals	....	60	
Privates	....	0		Privates	....	140	
Total, all ranks				Total, all ranks			
.... 4				.... 236			
Non-Combatants	....	38		Non-Combatants	....	32	
Horses	....	0		Horses	....	387	

Engineers.

The materials of which the Engineer troops are composed are particularly fit for the special services to which they are destined. Artisans of all kinds and mountaineers are selected. The pontoniers are particularly good, being recruited from boatmen, fishermen, and such like.

No recruit is taken for the Engineers under 5 ft. 1½ in., and unless broad shouldered. The Emperor Nicholas thought a great deal of this arm of the Service, and raised it nearly to a level with the Guard—a position which it has since maintained. The uniform resembles that of the Artillery, only with white-metal braid and buttons.

The Engineers of the Guard have black velvet facings, collar, cuffs, and cap-band; the Officers being distinguished by silver embroidery. Engineers of the line have dark green piping, and their Officers have a silver band to the collar; shoulder-straps red, with the battalion number upon them. Linen blouses are worn by working parties; black belts.

Arms and equipment the same as those of Infantry, except that they carry the shorter dragoon rifle and bayonet.

Non-commissioned officers and privates of the Engineer Field Train, also mounted non-commissioned officers and drivers of the pontoon train, wear short dragoon swords; non-commissioned officers being, moreover, provided with revolvers.

Working and Entrenching Tools.

All drivers of the pontoon train, as well as privates of the field and siege parks, are furnished with hatchets on mobilization. Each company of the sapper battalions carries with it, on the men's persons, 104 spades, 72 hatchets, 10 shovels, 20 mattocks, 8 hammers, 4 tracing lines, and 2 chisels; having in reserve 40 spades, 24 small axes, 16 broad axes, 5 shovels, 5 mattocks, 8 hammers, 6 crowbars, 4 fascine knives, 1 fascine choker, 2 rail-spanners, 2 grindstones, complete, 100 sand-bags.

Pontoon and miners' companies carry about the same supply of tools. The engineer train transports the reserve tools, each sapper battalion having attached to it 8 wagons for implements, with 32 horses; each pontoon battalion 58 pontoon wagons, with 372 horses and 24 spare horses; whilst the railway battalion has 4 wagons for tools and material, 2 wagons for explosives, and 29 horses. In peace time, five sapper battalions are provided with the whole engineering *matériel* and transport for four companies; but for one company, only with the tools carried by the men. The other sapper battalions are complete with material and transport for six companies.

In time of war all active sapper battalions and reserve companies are

complete in every way. Dépôt battalions have only the tools carried by the men.

The dimensions, &c., of Russian pontoons are as follows :—End sections, 14 ft. 1 in. long, 6 ft. $2\frac{3}{4}$ in. wide, 2 ft. 5 in. deep, weight 758 lbs., buoyancy 10,364 lbs.; middle sections, 11 ft. $5\frac{1}{2}$ in. long, 6 ft. $2\frac{3}{4}$ in. wide, 2 ft. 5 in. deep, weight 722 lbs., buoyancy 9,967 lbs.

From the materials of a whole pontoon park may be formed a bridge 340 to 400 yards long for infantry, cavalry, and field artillery, with four baulks in a bay; 300 to 315 yards long, for the same, and train with five baulks in a bay; 233 to 266 yards long, for siege artillery, with six baulks in a bay. The time occupied in bridging an ordinary stream, under favourable conditions, by the whole park is,—by running out, two hours; by bays, one hour; and by swinging, half an hour.

Drill Regulations and Training.

Apart from the technical work, engineer troops are drilled and trained just like infantry. The sappers especially distinguish themselves by the manner in which they perform field evolutions, often surpassing infantry battalions in steadiness and finish. Neither are they behindhand in shooting or in field duties. This is to be accounted for by the goodness of the materials of which the engineer troops are composed, and also by the fact that a large proportion of the sapper Officers come from the infantry—a circumstance which may possibly have a bad effect on the efficiency of the corps to which they are transferred in its own special duties, although such a result is hardly to be noticed. The tendency at present is to reduce the amount of infantry drill in the engineer battalions. We shall have occasion to notice, in our remarks upon the new system of instruction for the Army generally, how that of the engineers is conducted with regard to distribution of time, and with regard to the share taken by them in the summer exercises of all arms combined. Hitherto engineer troops have been kept much to themselves, and have been brought but little into connection with the other arms of the Service; but this separation is gradually becoming less and less marked, as the importance of the assistance given by the engineers to other troops in the field is more and more realized, in view of the necessity of obtaining artificial shelter from fire. The new instructions for the construction of shelter-trenches by infantry and cavalry require so much technical knowledge on the part of Officers and men thus employed, as to render it desirable that on such occasions they should be under engineer superintendence—a circumstance which is borne in mind and acted upon even at the summer exercises of all arms. To show how much importance is attached to the construction of field works, we may mention that a reserve supply of tools (in addition to those carried by the men) is now transported by infantry, cavalry, and artillery in the proportion of 10 spades, 24 hatchets, and 3 mattocks per company, 8 spades and 8 hatchets per squadron, and 16 spades and 16 hatchets per battery.

Technical Questions.

Engineer officers are apt to look with a slight degree of contempt and mistrust at what they consider the amateur performances of the other arms in the work of the sapper, and complain that too much importance is attached to rapidity of construction at the expense of solidity and of proper shelter. Experiments made at the sapper camp of Ust-Ischora proved, according to the official account, that parapets, one foot thick at the crest,¹ are a complete protection from rifle fire, but not against splinters of shell. To give fair shelter against the last-named projectile the parapet must be two feet thick at the crest, and no more, so that the shell may break through and burst well in

¹ The nature of the soil is not stated.

rear ; whereas, if the parapet were from four to eight feet thick, the shell would either burst in it, or immediately after passing through it, to the great damage of the defenders. A thickness at the crest of fourteen feet is looked upon as the minimum for absolute protection against shell fire, though this is evidently not attainable with hasty field entrenchments. Loopholes lined with gabions are condemned, as not offering sufficient resistance.

Ditches of triangular profile are not approved of, on account of the difficulties of construction. Entrenchments should be made in a thoroughly methodical manner, every step in the process by distinct word of command, just as in field exercise, so as to ensure greater completeness of execution. Works intended to cover guns should, if possible, be provided with "bonnets," and be half sunken.

Practice was made against a field redoubt provided with traverses and splinter-proofs, the result thereof seeming to show that a garrison thus sheltered would suffer little. The engineers, therefore, are much impressed by the value of field works, even against the improved artillery of the present day. It is not anticipated that the introduction, which seems probable, of light field mortars will much affect shelter-trenches ; but their effect on closed works is dreaded, and it is thought advisable to make such works of small dimensions in view of this danger. Experiments are now being made in this direction.¹

At the summer exercises in the practical work of the sapper and pontonier, practice of this nature is combined with tactical manœuvres, representing the attack and defence of positions, the passage of rivers, and so forth. The technical instruction of *railway battalions* and of men belonging to the *telegraph train* is in its infancy, but it is intended to be conducted on the German system. All the latest appliances, such as heliographs, optical signals, and telephones, have been introduced. Theoretical instruction is given very thoroughly in the battalion and brigade schools, the former intended to fit privates for the post of non-commissioned officer, the latter to impart technical training of a superior quality to the non-commissioned officer. There are also special courses for instruction in firing mines by electricity. The course lasts two years in the battalion schools (in connection with which are also company schools), being divided into an upper and a lower term ; but in brigade schools it only lasts one year, and the same applies to the mining course.

Officers and non-commissioned officers belonging to the corps act as instructors. The course in the battalion schools comprises the Russian language, arithmetic, geometry, fortification, artillery, drawing, army organization, and carpentry.

The same subjects are taught in brigade schools, but up to a higher standard. During the season of summer exercises, the scholars rejoin their several corps. There are annual examinations. Men who pass through the battalion schools with credit, and are in other respects deserving, are promoted to the first vacancies. The non-commissioned officers who have most distinguished themselves in the brigade schools receive the higher pay of a "conductor of the second class." The same allowance is given to the instructors and to the best scholars in battalion schools.

Officers of Engineers are divided into three classes : 1. *Military Engineers*, employed in the higher duties of the department ; 2. *Local Engineers*, who direct and superintend military buildings ; 3. Officers attached to sapper battalions and other bodies of engineer troops.

¹ The foregoing is an epitome of the views which Russian engineers are said, by Lieut. von Drygalski, to entertain on some engineer's questions. We give them for what they are worth, without thinking that they contain much that is novel or original.

All candidates for a commission in the Engineers may obtain one without passing through an Engineer school, by serving a certain time as a non-commissioned officer, and afterwards passing an examination in fortification, artillery, tactics, military administration, topography, architecture, law, and drawing, according to the programme in force in the Nicholas Engineer School. Candidates who have been educated in establishments where mathematics and natural sciences do not form part of the syllabus, have, in addition, to pass in physics, chemistry, analytical geometry, and elementary mechanics.

The new System of Tactical Instruction in the Russian Army generally.

Various circumstances peculiar to Russia have hitherto contributed to produce a great diversity of system and a great disparity of instruction in different portions of the Army: for instance, the many diversities of climate to be met with in so widely extended an Empire; the various degrees of concentration of the troops in different districts, affording more or less facility for supervision and combined action; the smallness of the barracks at some stations; the absence at many of covered drill-yards, so necessary in many parts of the country for winter work; the want of ranges, &c. Out of about 600,000 field troops in 1880, about 159,000 were quartered in barracks, the remainder being either in private houses occupied as barracks or in billets. The reserve and local troops are better off in this respect; the cavalry worst of all, regiments being often broken up and scattered amongst farms and villages.

The older soldier, who has a great deal of garrison duty to perform, had but little time for instruction of any kind during the winter months, except in the company and regimental schools, where there was always a good deal done. The recruits, who joined mostly in January, were drilled, not very efficiently, for four months, after which they spent from two to four months in camps of exercise, being assembled for the purpose of completing their training, sometimes by separate arms, sometimes in mixed bodies of all arms. During the remainder of the year the men were allowed to assist in harvest work, to cultivate the regimental vegetable-gardens, and to repose, none of which occupations conduced directly to tactical efficiency, whilst the cavalry and artillery horses were turned out to graze. In former days, when the term of service was longer, and when the demands on the skill of the individual soldier were much smaller, the system in force was sufficient to produce troops equal to all ordinary requirements, and, indeed, excellent as far as mere parade work goes. Now, however, that service with the colours has been reduced to five or six years, and that so much more is demanded of the soldier, both with regard to skill in shooting and to alertness and handiness in action; now, too, that so much is required of the Officer, even of the lower grades, in the way of intelligence and initiative, it is not surprising that, notwithstanding the gallantry and devotion of all ranks, the results produced under the system just described failed to be satisfactory when brought to the test of modern warfare. Hence, for some years back, commanders of military districts have endeavoured, by issuing annual programmes of instruction, as supplementary to the drill regulations, to improve, as far as possible, the training of their troops and to make good all palpable defects.

The Corps of Guards, the troops in the St. Petersburg district, in the general government of Wilna and in the kingdom of Poland, led the way in this matter. But where so much depends upon the competency of each commanding Officer, it is difficult to ensure uniformity, even with a strict system of inspection. The necessity for a considerable degree of uniformity was, however, apparent; and the want of it was still more clearly shown in the war of 1877-78, in consequence of which experience, the "Head Committee for Army Organization and Training" was appointed, whose first business was

to gain complete information as to the mode of carrying on the service in the different districts, with a view to the adoption of a programme suitable to all circumstances and situations.

All the reports thus collected were forwarded, with a series of questions, to the General Governors and Commanding Generals for their remarks and opinions, which they were requested to communicate to the Head Committee by the autumn of 1879 at latest. The whole mass of documents was next laid before a special mixed committee of infantry, cavalry, and artillery Officers (the Engineers had a committee of their own), which proposed during the winter of 1879-80 a project for the annual course of instruction. This was forwarded to the various Commanding Officers, for their remarks, and, after some alterations, was put in force on the 22nd September, 1881, under the title of "Distribution of Work throughout the year in the Army." We proceed to give an abstract of the principal regulations concerning the training of the different arms, including field service¹ and manœuvres.

The whole year is divided, for training purposes, into two main periods—that of winter and that of summer. The former is again subdivided into two sections, the first of which extends from October 1st to December 1st, that is up to the supposed embodiment of the annual contingent. In reality, however, cavalry recruits come in somewhat sooner; and those of the other arms somewhat later. The second section of the winter period lasts from December 1st to May 1st; that is to say, until the commencement of the summer exercise. The first section of the winter period is devoted to interior economy, school work, elementary drill, and to training drill instructors. Officers are practised in field duties with skeleton units. As soon as the recruits join, more pressure is put on, and the training of the young soldiers becomes the principal subject of attention. This training is regulated by very particular instructions, which go into the minutest details, bear the impress of great humanity, and show the desire to economize to the utmost the strength of the young soldier. In order to gain as much time as possible for special military training, recruits are not allowed to attend school during their first winter. Captains of companies have themselves to give instruction in all that concerns *morale* (love of country, feeling of honour, strict performance of duty, &c.). Subalterns and non-commissioned officers specially attend to the mechanical training (drill, handling of arms, and so forth). There is a special short course of drill laid down for the infantry recruit in war-time which is supposed to qualify him for the ranks in two months' time. Cavalry and artillery recruits do not require to be pushed on in such a hurry even in war-time, as those arms have a superfluity of reserve-men ever ready to fill up gaps.

There is also a special programme for the summer course (that for the Artillery, however, together with their "field exercises," is still under preparation). On the 1st of May all detachments assemble at the battalion or regimental head-quarters for the purpose of going through the prescribed exercises. This is done in order to ensure more complete supervision, as in the opinion of the higher authorities in Russia no Officer below the rank of colonel Commanding a regiment should have the power of modifying the programme.

This programme includes—1. drill; 2. field exercises against a supposed enemy, working out a tactical idea; 3. field exercises, one body acting against another; 4. field service; 5. exercise of units raised to the war strength; 6. the construction of field works and the strengthening of positions; 7. gymnastics as applied to field purposes (jumping, climbing, running, &c.); 8. rifle practice and judging distance.

The annual course is further subdivided, for infantry, into company drill

¹ By "field service" is meant everything relating to reconnaissance, outpost duty, camp duties, and what we call "minor tactics."

for six weeks, battalion drill four weeks, and regimental drill two weeks. These exercises, however, as well as rifle practice and field duties, are only partly executed at the regimental head-quarters, being in great measure performed at the large standing camps, where whole Divisions are assembled. The rifle brigades often occupy a special camp for rifle practice and exercise in field service, in which they excel, at Oran, in the Wilna district.

Cavalry.—Squadron drill lasts four weeks; and regimental drill three weeks. Regiments are now often concentrated in brigades and Divisions for field exercise, being only sent to the summer camps in combination with the other arms, when the special cavalry exercises have been completed. Both cavalry and artillery horses are turned out annually for four weeks to graze, either at midsummer, before the commencement of the manœuvres for all arms at the camps of instruction, or after these are concluded, according to the weather and to other circumstances.

The *Artillery* is mostly concentrated by brigades at large garrison towns, being exercised in their immediate neighbourhood. It is difficult to make an exact distribution of time for the battery exercises, because the number of places where ranges are available for artillery practice is comparatively small; and consequently some batteries have to march long distances to reach their place of assembly, which occasions a considerable loss of time. Again, owing to this scarcity of ranges, batteries and brigades cannot fire simultaneously; so that they cannot all take part in the combined manœuvres of all arms.

The *Engineers* are drilled from May 1st to June 1st. They then go through a course of practical training by companies for at least five weeks, and afterwards of brigade exercises in camps of their own during all the rest of the summer, except for the period of a fortnight, when they take part in the combined manœuvres of all arms.

The technical training of engineers is so extensive that they often cannot complete their course in one summer, but have to carry it forward to another year. It is in contemplation, therefore, to lighten their labours by shortening their course of rifle practice, and by reducing the amount of their tactical instruction, in both which branches of work they often surpass the infantry, as we have already mentioned. The combined manœuvres are carried out in the large summer camps, and last four weeks, taking place earlier or later, according to the time of harvest. The infantry do their long-range shooting and their field firing at these camps; but their principal object is to accustom the different arms to work together either against a represented or supposed enemy and in the practice of field duties. Officers also have "skeleton drill," which in the case of artillery and cavalry takes place at the grazing season.

Schemes of instruction have been drawn up to serve as a general guide, so as to ensure steady and regular progress, being calculated for an Infantry Division, with its artillery brigade and detachment of engineers, and for a Cavalry Division, with its complement of Horse Artillery.

All rules are clearly laid down for regulating the manœuvres, in which the umpires play a very important part.¹ Great attention is paid to the work of reconnaissance, to skill in occupying ground and in strengthening positions, and to the harmonious co-operation of the different arms. At the end of each manœuvre the commanding General makes a critique of the whole performance in the presence of all the Officers. The principal peculiarity to be noticed is the practice of night-marches and of outpost duty by night, first by moonlight and on known ground, afterwards on a dark night and on unknown ground. These night drills are supposed to last not less than twelve hours, whilst those carried on by daylight last at least six hours at a time. Marches of mixed detachments on a large scale are to take place also in winter, and

¹ And too often are obstructive, partly from slowness and want of decision. A sufficient supply of really trustworthy umpires is difficult to find in any army.

were practised for the first time in February, 1882. In order that Officers and men may gain a better idea of the conditions under which they will have to manœuvre on service, all the companies of a battalion are occasionally formed up together into one company, and all the battalions of a regiment into one battalion for drill. Each captain is, if possible, to have the opportunity, in the course of the summer, of commanding a company on the war footing.

Cavalry, as well as infantry, practise throwing up field works. When this is done on an extensive scale, engineers are, if possible, to take part in it; but all Officers are expected to know how to trace works, and how to direct the workmen.

By *field gymnastics* men are trained to get over every sort of obstacle in the quickest and best manner, in doing which they go through a systematic course of instruction.

Rifle practice and judging-distance practice have already been treated of in connection with the special training of infantry. The regulations, of which an abstract has just been given, only came officially into force in 1882; but their general tenour was well known in 1881, and they were more or less completely acted upon at the different summer encampments in that year, so that some idea may already be formed of their general effect. The prevailing opinion appears to be that they are, on the whole, very good, and calculated to produce a uniformity in training, which was previously deficient. Where they seem to err is in being too minute and detailed; at the same time, if adhered to strictly, not a moment of the time available for instruction will be wasted—a matter of great importance in a country like Russia, a large portion of which enjoys but a short summer; and, indeed, notwithstanding the most careful economy of time, the summer-drill period is too short for all branches of training to be attended to as thoroughly as desirable. One great defect of the system is said by some to be that mere drill occupies too much time at the expense of higher training, a main cause of which is the system of assembling the troops in large camps of instruction, where the ground available for exercise is but small in proportion to the number of troops concentrated. It is generally also flat and open, and becomes shortly quite familiar to all Officers; and as the troops may not go beyond the ground immediately surrounding their camps, on account of the standing crops, the different corps get into each other's way.

The same inconvenience arises in target practice, especially in firing at what should be unknown distances. *Moreover, a large concentration of troops is a temptation to have frequent inspections and reviews, which interferes with real work*, although, by the new regulations, these shows are reduced to a minimum.¹ Then a good deal of time is taken up every year in making the constructions necessary for camp life. The upshot of it all is that, although the troops parade twice a day for drill, a part of the prescribed course has to be omitted for want of time, and other parts, such as rifle practice, judging distance, field duties, marching out, &c., can only be gone through in a cursory manner.

The late General Skobelev, whilst in command of the 4th Army Corps in the summer of 1881, started manœuvres on the German system; that is to say, on ground unknown to those engaged, and conducted in a practical service-like manner. His two Divisions were quartered in separate camps, and operated against one another towards the close of the proceedings. The results appear to have been satisfactory, except in the case of the cavalry, which is said not to have been as active as it might be.

It is said that Russian Officers generally agree in thinking that it would

¹ This is especially the case when the "camp of instruction" is near the metropolis, like our own Aldershot, for instance.

be desirable to substitute for the large summer camps smaller concentrations of troops by regiments or brigades, with a due proportion of cavalry and artillery attached, in the neighbourhood of the head-quarters of the troops assembled, for the purpose of going carefully through all the branches of military training; and then to conclude the year's work, according to the example set by General Skobelev's corps, with a real manoeuvre on a large scale carried out by two bodies opposed to one another. If this scheme were carried out, the troops would doubtless be better trained in all the details of their duties, and subordinate Officers would be thrown more upon their own resources, thus gaining confidence and experience; but circumstances in Russia are against it, and before it can be worked with success changes must be made in the distribution of the troops and in the mode of supervision exercised by the higher Officers, who at present do not appear to leave sufficient latitude to those under their command.

Many Russian authorities also are in favour of doing away with the leave granted annually for harvest work, which leave is given solely, as is well known, for the purpose of affording the soldier a chance of adding something to his very poor pay. This harvesting not only causes a great loss of time which would be valuable for military purposes, but is also prejudicial to discipline. The practice, too, of turning the horses out annually to graze is also naturally condemned, as the animals lose condition just when they are required to be in full vigour. Reform in these matters is merely a question of time, and depends upon financial considerations. Prolongation of service with the colours is another point in contemplation which, if carried out, will tend to facilitate military training.

Military Transport.

The organization of this important part of an Army is at present in a provisional and rather chaotic state, very detrimental to efficiency. At present, every regiment and every other independent unit, also each of the higher staffs, has its own so-called *intendance train*, comprising carriage for Officers' baggage, the military chest, orderly room, prisoners, ammunition, sick, and medicines, &c., always ready, as far as *matériel* goes, and even in peace-time partly provided with draught animals and drivers.

We have already noticed the *special trains* belonging to the Artillery and Engineers in our account of those corps. In addition to the *intendance train* which accompanies the troops and forms the first line of transport, there follows a second line of so-called *intendance transport*, the amount of which is uncertain, and is determined only on mobilization. Each of these *transport trains* carries ten days' provisions and three days' forage for an Infantry Division and the Cavalry attached to it, being divided into four sections, and having an establishment of 5 Officers, 3 officials, 42 non-combatants, 48 baggage masters (non-commissioned officers), 648 privates, 580 wagons, and 1,290 horses. The whole of the *intendance transport trains* of a field Army are under a *chief of intendance transport* (a General), who is directly under the Chief of the Staff of the Army, and not under the Commissary-General, who is also a General Officer.

The Chief of the Staff has, with regard to the *personnel* of the *intendance transport trains*, the jurisdiction of a General Commanding an Army Corps; and the chief of *intendance transport*, that of a Divisional General. A transport commander (Field Officer or Captain) commands each transport train, with the powers of an independent battalion Commanding Officer. The *personnel* of each section of the train forms a *baggage company*, under a superior Officer, with the powers of a Company Commander. Besides the above-mentioned organized military transport, there may be an indefinite number of hired or requisitioned vehicles to supplement it. There is no

special *transport corps*, such as exists in most European armies. The men who are attached to the trains wear the uniform of the corps to which they belong, and are armed only with hatchets, the non-commissioned officers carrying sabre and revolver. Most of the men are drawn from the cavalry reserve, which has always a good many men to spare after the cavalry regiments are completed. The Officers are told off specially for baggage duty, being selected from Officers and non-commissioned officers who have retired from the service, but who return to it on mobilization.

Matériel.—There are at present two totally different systems in force—the old and the new. With regard to the former, we will give, by way of example, the details of the war establishment of transport for an infantry regiment:—16 ammunition wagons, 17 provision ditto, 5 for carriage of sick, 1 for orderly room, 1 for paymaster, 1 apothecary's wagon, 1 for tools, 1 for hospital necessities, 16 tent wagons, all with four horses; 1 apothecary's cart, with one horse: altogether 60 carriages, with 249 horses and 125 men.

With the so-called new system, there are both light two-horse carts (pattern 1876) and four-horse wagons.

For each infantry regiment, 10 baggage carts for Officers, 16 provision carts, staff ditto, 2 ambulance ditto, 1 apothecary's ditto, 1 hospital stores ditto, each drawn by a pair of horses; 12 ammunition wagons, 16 or 17 provision wagons, 1 staff ditto, each drawn by four horses. Total for regiment, 61 or 62 vehicles; 180 or 184 horses.

Some regiments have, in place of the 16 (four-horse) provision wagons which follow in second line with the divisional train, 32 two-horse carts. Since the last reductions, a very small proportion of these vehicles are horsed in time of peace. Other units are supplied with carriage, each in similar proportion to its strength: thus, for instance, a cavalry regiment has from 18 to 20 vehicles, with from 43 to 51 draught horses. The Turkestan brigade of rifles has pack animals in lieu of carts; for the four battalions, 84 in peace and 388 in war, including 331 camels.

In the Caucasus, each infantry regiment has 64 additional four-horse wagons for tents.

All the different kinds of vehicle hitherto in use were proved to be very defective during the war of 1877–78, principally on account of the small amount of stores which each could carry in proportion to the dead weight; in consequence of which the horses were overworked, especially on bad roads, which were not uncommon, and the baggage train was often several marches in rear of the troops, who were thus in want of the most necessary articles.

A Commission was appointed in 1881 to study the subject of the best system of organization and equipment for a baggage train, which Commission has been sitting since September, 1881, without, as far as we are aware, coming to a decision. All the wagons submitted to it for approval were rejected; but it is believed that the four-horse wagons used by the Russian border peasants are considered the best, and next to these wagons entirely constructed of iron. Whatever conclusion may be arrived at, one thing is certain, that a reconstruction of the military train will entail a large expenditure, and will require much time; the most urgent question, therefore, is, how best, in case of need, to utilize the existing *matériel* so as to combine the utmost attainable mobility with due attention to the wants of the soldiery.

The best and only present remedy seems to be that of increasing the number of draught horses for most of the vehicles. In order to make the matter more intelligible, we will give a few details with regard to the supply of ammunition and other necessities to troops on service in the field.

First and foremost comes *ammunition*. The soldier carries sixty rounds on his own person. The twelve ammunition wagons in first line, which accompany the infantry regiment, carry sixty rounds per man. Each of these wagons has a dead weight, including the *personnel* and forage for its horses, of about

24 cwt. ; so that it is not possible, without overloading, to carry more than about 8 cwt. of ammunition.

Now, assuming the strength of a regiment in privates to be 3,200, to supply them with sixty rounds per man, we require 192,000 rounds, the weight of which is about 182 cwt. ; that is to say, we want carriage for over 15 cwt. of ammunition on each wagon. But the reserve entrenching tools are also carried on the ammunition wagons, making an additional load for each of nearly 3 cwt. The total load per wagon, including dead weight, will thus amount to 42 cwt., or $10\frac{1}{2}$ cwt. per horse, instead of about 9 cwt., which is considered the maximum. When carrying so excessive a load, it is impossible for wagons to keep up with the troops, except on good roads ; and in action, when they will be required constantly to leave the metalled roads, they must needs lag behind. One remedy proposed is, that the number of rounds per man carried on the regimental wagons be reduced from 60 to 36, in which case the soldier would have to carry eighty-four rounds on his own person. This, however, can only be done if the weight of his equipment be reduced, as, indeed, has been proposed, by substituting a light canvas valise for the present knapsack. Another expedient would be to increase the number of wagons ; but this appears to be inadmissible when we consider the immense mass of vehicles already accompanying an army. Thus we must needs come back to the proposal of adding an additional pair of horses to each wagon, as the one only immediate way of helping us out of the difficulty.

This additional pair of horses will, of course, entail an extra man to look after them. There being plenty of horses in Russia, and the animals being subject to conscription, this change might be carried out pretty quickly, though, of course, it would cost a good deal. With six horses to each wagon, the reserve ammunition wagons might be made to carry 90 rounds per man instead of 60, which would no doubt be an advantage.

Next comes the carriage of food, in which we find the same difficulty. The sixteen or seventeen two-horse carts and the sixteen four-horse wagons carry altogether for each man five days' biscuit, three days' groats, salt, and lard, besides camp-kettles and other cooking necessities, the company books, implements, stretchers, &c. The two-horse cart, one of which is allotted to each company, has to carry one day's biscuit, &c., for each man. Reckoning the company at its full strength of 240 men drawing rations, this entails a weight of nearly 12 cwt. ; add to this the 15 cwt. dead weight of the two-horse cart, and we have a total of 27 cwt., or $13\frac{1}{2}$ cwt. per horse. A third horse is, therefore, here required.

The sixteen four-horse wagons transport the remainder of the rations, the weight of which is about $17\frac{1}{2}$ cwt., which, added to the dead weight of 24 cwt., makes up a total of $41\frac{1}{2}$ cwt., or over 10 cwt. per horse. As it is not advisable to reduce the supply of provisions carried actually with the army, which amounts, including the three days' rations in the soldier's haversack, to eight days' rations, it is evidently advisable to give an extra pair of horses to the four-horse provision wagons.

Again, take the case of the Officers' baggage carts, which are always supposed to keep well up to the front : each field Officer being allowed 178 lbs. and each Captain 89 lbs., the total weight on each of the ten carts is about 25 cwt., that is, $12\frac{1}{2}$ cwt. per horse. Here also a third horse is required.

The ambulance train of the regiment consists of the apothecary's cart, of the hospital-store cart, and of two light ambulances, each for eight sick. It has been already determined to increase the number of horses for each of these three latter vehicles from two to four, in which case the load will amount to about 9 cwt. per horse, which is not excessive. But the apothecary's wagon is so heavy that even four horses are not enough to draw it. Too large an allowance of hospital stores seems to be carried ; at any rate, too large for the transport allowed. At present the supply is for thirty-six sick per regiment.

It has been proposed by the chief medical committee to reduce this number to sixteen. Even then more than 22 cwt. would have to be transported, which is more than the existing means are equal to.

All these details serve to prove how far behind its requirements is the organization of the Russian field train. Deficiencies in this respect are, indeed, to some extent made good, when the need arises, whether at home or abroad, by requisitioning or pressing wagons for the public service. This was the case more especially during the late Turkish war with the intendants transport, which made great use of such means for adding to its supply of vehicles. But, after all, there is in the Russian baggage service even a more important defect than the want of proper *matériel* and of baggage animals, and this is the want of proper military organization and of supreme control. As an example of this, we may mention that, during the war of 1877-78, the head-quarter baggage of the Grand Duke Nicholas required 500 vehicles and 1,500 horses to transport it, and had to move in four successive columns. Even the first column, which was supposed to keep up with the Grand Duke, was frequently one or two days' march to the rear, so that the head-quarter staff were often in want of the commonest necessities. Such being the case, the hardships undergone by the troops may be imagined.

Special battalions and squadrons of the military train should doubtless be created as a nucleus for this important service.

In Table III of Lieut.-Col. Hildyard's valuable article on "The Intendants, Transport, and Supply Services in Continental Armies," in No. CXVIII of the Journal R.U.S. Institution, will be found the "present establishment of regimental trains in Russia," with many details omitted in the present paper.¹

Intendants and Supply.

The Field-intendants Department is responsible for the whole supply of an army in the field, being one of the five chief departments of Army administration, and directly under the Commander-in-Chief. At its head is the chief of the field-intendants, under whose control are the intendants of Army Corps, Divisions, and detachments, also those of the military districts bordering on the theatre of war, as well as any local administration which may be formed in the enemy's country during the course of the operations.

As far as regulations go, everything connected with Army supply in the field is carefully arranged. Purchases are either made directly by the intendants, or else supplies are obtained by contract or by requisition. During the last war both the system of direct purchase and that of contract completely broke down, the supplies obtained from both sources, even of clothing and warlike stores, being utterly inadequate. This was due partly to incompetence and confusion, partly to dishonesty on the part of those employed, but not by any means to want of resources.

In the absence of local means of supply, troops in the field are rationed from the three days' supply carried by the men, and from the five days' subsistence in the regimental and Divisional wagons, which are replenished in the various manners above mentioned, or from the various magazines which are established on the lines of communication. Two or three marches in rear of the regimental or Divisional trains there should be one of the intendants columns, which carries from eight to ten days' provisions of all kinds for the Division, together with the special troops attached to it, in 580 vehicles, drawn by 1,290 horses. This column is completed with supplies in the same manner as the trains in the first line. Hence rations of all kinds, except meat, for from sixteen to eighteen days, are supposed to be ensured by

¹ Commanding officers are said by an eye-witness of the last Russo-Turkish War "to break through all regulations, and to have a vast number of vehicles at their disposal, which turn out very useful on service."

the trains in first and second lines. A further reserve (the so-called intermediate magazine) follows at a distance of from two to three days' march, with from fifteen to thirty days' supply. Further to the rear again, and connected by rail with the base of operations, is the grand magazine, with from thirty to sixty days' subsistence for the Army Corps or Army. The provision train of an army of ten Divisions is said to convey ten days' supply for 230,000 men. Stores are conveyed from the magazines in rear to the front, should there be no railway available, by means of hired transport. The Russian authorities have, with wise foresight, formed large supply magazines near the western frontier, which magazines are kept full even in time of peace. At Wilna, for instance, there is a large military bakery, in which some hundreds of men are employed. There are besides supply dépôts in all the military districts, and stores of clothing and equipment, all under the intendance.

The supply of *forage* for the horses is regulated in a similar manner. Every saddle horse always carries two days' supply, and every baggage animal four days' supply. From two to four days' march to the rear is an *expense magazine* of forage; and at about the same distance again, towards the rear, is an *intermediate magazine*, with from fifteen to thirty days' supply of oats or barley and of hay. It is not usual to transport hay or straw to any distance, and the troops must, as far as possible, obtain them locally.

Ammunition.—The supply is ensured by equally systematic regulations, through successive échelons,—first, in the men's pouches and on the limbers; secondly, half a day's march in rear come the small-arm and gun ammunition wagons; thirdly, from one to two days' march further back, the sections of the "*flying divisional park*;" fourthly, at the distance of two or three days' march, the *mobile parks*; fifthly, three or four days' more to the rear, and next to the base, the great *ammunition magazines*, which are in the same line with the *advanced artillery matériel dépôt* and the *provisional small arms magazines*, which are all completed from the dépôts in the military districts.

The Engineers are supplied with reserve equipment of all descriptions, from the Central Engineer Arsenal at Düna-burg, in which everything required for the train of a sapper battalion and of a pontoon half-battalion is constantly kept in readiness, as well as materials for preparing a second equipment of the same dimensions. There are, besides, several dépôts of entrenching tools and other siege *matériel*.

With regard to the foregoing details upon the system of supply in the field, it may be well to remark that they are gathered from official documents, and undoubtedly show what the regulations are upon the subject. How far these, apparently complete, arrangements are carried out in practice we cannot say, and, remembering the great deficiencies which came to light during the last war, we cannot help being somewhat sceptical on that head.¹ At the same time we have the fact before us, that the Russian military authorities were fully alive to the shortcomings of the services of supply and transport, and that commissions of inquiry have been busily engaged, since the war, in going to the root of the matter. Hence, it is natural to suppose that important reforms have really been made.

Let us, for a moment, compare in a summary manner the provision made in the Russian Army (according to regulation) with that made in the Austrian and German Armies, for the supply of food and forage for an Army in the field.

¹ We may instance the well-known fact that, during the early stages of the siege of Plevna, there were no entrenching tools to the fore, and the gallant assailants had to scoop out cover for themselves with their fingers and with the lids of their mess-tins; demonstrating, not for the first time in warfare, the necessity of making the soldier carry an entrenching tool on his own person—a necessity now acknowledged and more or less provided for in all armies."

We shall find that the arrangements in Russia are on the largest scale, whilst those in Germany are on the smallest scale of the three Powers mentioned. In the matter of ammunition Russia again heads the list, whilst Austria is at the bottom of it.

The supply of entrenching tools and other siege *matériel*, also for the construction of telegraphs, is much larger in a Russian Army than in a German or an Austrian force.

In Russia, as we know, the Army Corps does not occupy the same important position as a tactical and administrative unit as in most European Armies. It is significative of this, that there is no special Army Corps train except for its staff. But, taking the Army as a whole, it is very richly endowed. The train for an Army, consisting of five Army Corps, consists of 7,742 vehicles, 20,723 horses, and 12,152 men, besides 4,000 reserve horses, with 1,548 men. This is exclusive of regimental and divisional trains and hospitals: including these, we arrive at a grand total of 17,000 vehicles, 41,700 horses, and 45,200 men.

An Austrian Army of the same size would require 15,300 vehicles, 46,000 horses, and 39,400 men; whilst a similar German force would only be encumbered with 8,800 vehicles, 34,500 horses, and 28,000 men.

A Russian Army has always, moreover, in addition to its military train, an enormous number of hired and requisitioned vehicles, which, however, will probably be the case with the Army of any Power during long-protracted operations. It certainly was the case with the German Armies in France in 1870-71, notwithstanding the important assistance given by the railways.¹

The Hospital Department.

In peace time there are, in addition to the *personnel* of the hospitals, and to that attached to the higher staffs, one regimental surgeon and four battalion surgeons per infantry regiment, and one dresser to each company. Other corps have a medical staff on a similar scale, in proportion to their strength.

Military surgeons in Russia are not Commissioned Officers, but civil officials, with military uniform and relative rank. Regimental surgeons rank as Field Officers, up to Colonel; junior surgeons, as Captains and Lieutenants.

The sick are at once sent to a general hospital, if there be one at hand. These institutions are of various size, up to 1,000 or more beds. Should accommodation for less than 150 sick be required at any considerable distance from these general hospitals, *half-hospitals* or *detached hospitals* are formed. In many places, military patients are treated in civil hospitals.

Wherever there is neither a *general hospital* nor a civil hospital, *military infirmaries* are opened, if necessary, with from 200 to 500 beds. Some of the Guard regiments have so-called *reinforced infirmaries*, which, unlike those of other corps, remain in Petersburg when the troops take the field. All hospital attendants wear uniform.

All military medical institutions are under the District Military Medical Commission, which is responsible to the District Inspector of Hospitals, who is one of the District Staff Officers.

Every hospital and other medical establishment is in like manner under a combatant Officer—an arrangement highly disapproved of by Russian military surgeons as detrimental to efficiency.

In war time the same dual system exists. Medical establishments of

¹ A compressed ration of forage "was very extensively used by the mounted branches of the Russian Army during its campaigns in Turkey, the weight of which was only 3½ lbs.; and it was of so portable a nature, that a supply of from four to five days could be carried attached to the saddle, without inconvenience to horse or man." (Colonel Hildyard's article on "Intendance, &c.," p. 902, No. CXVIII, "Royal United Service Institution Journal.")

every description are under two chiefs : first a General, who is inspector of hospitals ; and secondly, in respect of purely technical and medical questions, an army surgeon—the *military medical inspector*. Both these Officers are responsible to the chief of the staff of the Army.

According to existing regulations, when the Army is mobilized—1. *Provisional military hospitals*, each for 35 Officers and 600 men, are organized. These follow the Army at the distance of several days' march, being distributed according to the directions of the Commander-in-Chief. Each hospital has a separate train, 3 apothecaries' wagons, 24 other vehicles, and 114 horses. Neither men nor horses are maintained in time of peace, but all necessary *matériel* is kept in the intendance dépôts. 2. *Mobile hospitals* are formed by order of the Commander-in-Chief. These keep up with the Army, each being supplied with the *matériel* of two *mobile Divisional ambulances*. 3. The mobile Divisional ambulances are created for the care of sick whilst the troops are in movement, and for forwarding them at need to the nearest provisional and general hospitals ; also for collecting and tending the wounded on the battlefield, and for taking care of the more serious cases until sent back to the provisional hospitals. The Divisional ambulance has accommodation for 6 Officers and 160 men. It may be divided into two sections. The *personnel* consists of 10 surgeons and assistants, 3 Officers, 209 men, and 1 chaplain ; also of a company of bearers, numbering 1 Officer, 9 non-commissioned officers, 200 privates. The baggage train of the ambulance comprises 24 small and 6 large ambulance wagons, 2 heavy and 3 light apothecaries' wagons, 2 wagons for furniture and provisions, 22 for tents, 223 draught horses, and 7 saddle horses. In peace time the *personnel* is reduced to a minimum, and is included in the establishment of Infantry Divisions. Horses are only maintained in time of war ; the *matériel* is under charge of the infantry regiments. 4. The *regimental field ambulances*, which are always in the immediate neighbourhood of the regiment or corps to which they belong. To them the sick resort in the first instance, and, after receiving the first treatment, are despatched to the nearest hospital or Divisional ambulances. The regimental field ambulance is provided with tents and with ambulance wagons. When the troops are halted, it is opened, if required. During an action the ambulance wagons are posted from three-quarters of a mile to one and a half mile in rear of the fighting line, the wounded being brought to them on stretchers by the bearers, supplied with what is urgently needful, and again removed on stretchers to the Divisional ambulances, which are posted from three-quarters of a mile to one and a half mile further to the rear. In line with these latter are also the Red Cross establishments. All wounded men who can bear transport are removed in the wagons belonging to the Divisional ambulances to the provisional field hospitals and Red Cross hospitals, whence they are again despatched, as soon as possible, to the nearest railway station, and distributed over as large an area as can be. The system just roughly described was in force during the late war, and did not satisfy those who had to work it.¹ Immediately after peace was declared, a special Commission was assembled for the purpose of preparing a scheme for reorganizing the service of field hospitals in time of war. The Commission has made its report, which is believed to recommend considerable changes, the result of which will be a very great increase to the means at the disposal of the Medical Department of an Army in the field.

It is proposed to divide the medical establishments into two main sections : 1st, Field ambulances ; 2nd, Provisional field hospitals. Under the first head are included—A. Divisional ambulances at the head-quarters of Infantry

¹ One who was present at Plevna states, however, "I never saw wounded or sick so rapidly removed. This perhaps was because the Russian Army was stationary, and the regimental baggage trains could be requisitioned on emergency."

Divisions ; B. Regimental ambulances with regiments of cavalry and infantry, brigades of artillery, &c. Under the second head are included—A. Mobile Divisional hospitals ; B. Mobile provisional field hospitals ; C. Provisional reserve hospitals ; D. Sanitarium for convalescents ; E. Convoys for the evacuation of sick and wounded by road ; F. Hospital railway trains. Regimental ambulances will be in first line, and Divisional ambulances in second line, the two combined being on such a scale as to give the immediate attention required to 2,000 wounded per Division. There will be eight stretcher-bearers on the strength of each company, and a company of 200 bearers with each Divisional ambulance. Both regimental and Divisional ambulances will be entirely under medical authority.

The mobile provisional field hospitals are provided with military transport ; but the reserve provisional hospitals depend upon transport obtained by hire or by requisition. Each of these hospitals, of which there are to be eight per Infantry Division (four mobile and four reserve), will accommodate 10 Officers and 200 men. Therefore the seventy-six Divisions provided for by the new scheme (instead of seventy-two as hitherto) will require 608 provisional field hospitals, which will accommodate 127,680 sick. One mobile provisional hospital will be allotted to each Infantry Division, whilst the rest of these and all the reserve provisional hospitals will be at the disposal of the Army Head-quarter Staff.

The train of the mobile Divisional hospitals will be used for the transport of hospital *matériel* ; not for that of the sick, for which separate carriage is provided. Field hospitals are to be managed by committees, each of which will consist of a senior surgeon as president, of a junior surgeon, and of a paymaster. The supreme control, however, rests with a combatant Officer. This system of divided command, thus retained in the case of the field hospital, though abolished in that of the ambulance, is very distasteful to the medical staff.

The provision for sick and wounded, large as it is under the new scheme, is still considered by experts to be insufficient ; and the opinion prevails in Russia that, even with the best and most liberal arrangements, private assistance cannot be dispensed with in war to supplement what is provided by the State ; moreover, that volunteer assistance in the case of sick and wounded must be welcomed even in the first line.

According to the Returns of January 1, 1881, there were in the Russian Army, altogether, 2,508 surgeons, 256 apothecaries, 269 veterinary surgeons, 3,954 dressers of the 1st class, 2,743 dressers of the 2nd class, attached to companies, squadrons, and batteries, and 1,099 veterinary assistants. The surgeons were 279 under the peace establishment.

The Army medical staff is recruited from the Imperial Medico-Surgical Academy, in which the course of instruction lasts five years. There were on January 1, 1881, 1,073 students, including 105 of the veterinary art. In 1880, 388 students passed into the service, of whom 193 as surgeons and 24 as veterinary surgeons. As the medical staff has to be more than doubled in time of war, the supply from the Academy is quite insufficient. There are also schools for *dressers*, in which the course lasts four years. On the 1st January, 1881, they contained 1,285 scholars, of whom about 250 passed out during the year. Dressers are also trained regimentally ; and of these there were 6,097 under instruction on 1st January, 1881, 2,780 having passed as dressers from the ranks during the previous year.

[To be continued.]

INSTRUCTIONS FOR THE CONDUCT OF THE INFANTRY
SOLDIER IN ACTION.¹

By Lieutenant-Colonel R. v. BOGUSLAWSKI.

Translated by Captain W. SAWYER, Royal Lancaster Regiment.

[The framer of these "Instructions" is the author of the "Tactische Folgerungen" and a number of other valuable works well known to military students. Colonel Boguslawski has most kindly given his permission for the insertion of a translation of the "Instructions" in this Journal.—L. A. H.]

Preface.

In publishing these "Instructions for the Conduct of the Infantry Soldier in Action," which were originally printed for use in the 2nd Battalion Grenadier Regiment No. 6, in the place of the books of instruction in general use in the Army, I am complying with the request repeatedly made to me to render it accessible to larger numbers.

Notwithstanding the numerous improvements made in the compilation of similar books of instruction during the last decade, a conclusive solution of this difficult though apparently insignificant subject cannot be said to have been arrived at.

Besides general comprehensibility, clearness, and simplicity, a suitable arrangement of the matter and a composition adapted to the perceptive faculties of the soldier are principal conditions to be fulfilled.

Frequently, however, the soldier is still supplied with too much on some points and too little on others. For instance, the following may be regarded as too much :—Tactical details and formations which the soldier learns on the parade ground, or matters connected with troop leading when gone into at any length.

As too little :—When the conditions of real warfare are superficially considered, or perhaps not touched upon at all, which, the rather, should be handed down with all the greater faithfulness, the longer the duration of peace.

The main requirements of theoretical instruction appear to me to be briefly to lay before the soldier simple, easily understood rules for fighting, illustrating the fundamental laws, and representing a true picture of real warfare, and to convey to him only so much of the duties of commanders as actually concerns him.

This is the first object I have had in view. My second object is to assist superiors as much as possible in imparting instruction, for it is an old-established experience amongst troops, that most instructors find great difficulty in adopting a suitable subdivision and following the thread of the subject, especially when giving instruction on "the Battle."

The object of arranging the subject into short subdivisions and numbered propositions is further to facilitate the framing of questions and answers, to enable the instructor to work out the several propositions in his own way and suitably to his men's powers of comprehension, to apply them practically, and to support them by examples.

It need hardly be remarked that this little work belongs to quite a different category than my previous military writings.

¹ "Unterweisung für das Verhalten des Infanteristen im Gefecht." Von A. v. Boguslawski, Oberst-Lieutenant. Zweite Auflage. Berlin, 1882. Mittler und Sohn Pamph. 19 pp. Price 12 pfennings (about 1½d.).

It possesses this, however, in common with the greater part of them, viz., that it is drawn from actual experience.

Besides the maintenance of steady drill, and the continued perfecting of the men's training, endeavours should always be made to obtain a further advance in the province of their intellect, and in the development of their warlike character.

To contribute something to this end cannot be regarded as too paltry a task for anyone.

INSTRUCTIONS FOR THE CONDUCT OF THE INFANTRY SOLDIER IN ACTION.

1. Infantry possesses this advantage over the other arms, that it can fight both on the offensive and defensive under all circumstances, and on every description of ground : on the plain, on mountains, in woods, villages and towns, in close and open country.

Fighting Formations.

2. Infantry fights principally in extended order.

3. Close formations are usually only suitable for marching up troops for the fight. They are, however, occasionally used during the fight, mostly by night, in surprises, and against cavalry. Troops in second and third line are also in close formations.

4. The fighting line is composed of half-companies, groups, and files.

5. An interval of several paces, increased or diminished according to the nature of the ground, is kept between half-companies and groups.

6. The half-company, group, and file, by which the others march, is called the "directing half-company, group, or file."

7. The nearest body of troops in close formation behind the fighting line is called the "support."

The Duties of Half-company and Group Leaders.

8. The duty of the half-company, section, and group leaders is to direct the firing as far as possible.

9. It is consequently for them to decide what object is to be fired at, the distance, the sighting, and the description of fire to be employed.

10. For the better controlling of the firing the half-company leaders name a certain number of rounds, usually between three and five, after the expenditure of which a pause in the firing ensues.

11. The object of this pause in the firing is to allow the smoke to clear off, to subdue the excitement and unsteadiness of the men, and to enable them to receive fresh orders.

12. It is further the duty of the half-company and group leaders to keep their men in the correct formation and to lead them properly to the front or rear.

The Conduct and Movements of the Individual Soldier.

13. The soldier should move in a free and unconstrained manner and at a smart pace.

14. Should he be required to double, he will be specially ordered by word or signal to do so.

15. He will carry his rifle either at the short trail or at the secure. In running the rifle may be held in the right hand, raised.

16. The soldier must never lose the connection with his right and left-hand man. He must carefully observe the direction in which the firing line may be marching, and must conform to the same.

The various Kinds of Fire, and Fire Discipline.

17. The several descriptions of fire are :—

Firing in extended order.
 Rapid firing in extended order.
 Volleys by groups in extended order.
 Volleys in close formation.
 Rapid firing in close formation.

18. With reference to distances, firing is divided into :—

Short-range firing, up to 400 mètres.
 Long-range firing, from 400 to 700 mètres.

19. It is only under very special circumstances that firing is ordered at a greater range than 700 mètres.

20. The soldier must carefully husband his ammunition, as it is easy with the breech-loader very soon to come to the end of it.

21. Firing must cease immediately on the beat of the drum, and on the signal or long-drawn whistle from the half-company leader.

22. In delivering volleys any man who fires in advance of the others will be severely punished.

On the proper Use of the Accidents of Ground.

23. With reference to the "fire fight," the soldier must be posted in such a manner as to have a clear field of fire.

24. He must also understand how to make good use of ground as cover and as a rest for his rifle, *i.e.*, undulations, walls and hedges, fences, large and small trees. He must know how to fire from windows, loopholes, shelter-trenches, and earthworks.

25. The soldier must understand how to stalk the enemy's position, *i.e.*, to approach it unobserved under cover as close as possible.

26. The men may be said to be properly trained when in changing position the groups are able to take up their places in the new position in such a manner as to be well under cover and favourably posted for firing, with great rapidity, and yet with steadiness, and without crowding or unduly opening out.

The Soldier's Position in Firing.

27. The soldier must be thoroughly practised in firing in the several positions.

28. These are—

Lying down without a rest.

Kneeling ,,

Standing ,,

Lying down with a rest, *i.e.*, the shelter-trench parapet.

Kneeling ,, *i.e.*, over walls, fences, and from shelter-trenches.

Firing through loopholes.

Firing standing and kneeling from behind small and large trees.

Firing lying down is the most usual position in action.

On the Range, the Object aimed at, and the Sights.

29. The sights are always aligned on the bottom of the object aimed at, except in the following cases :—

At objects of less than a man's height—

(1.) From 75 to 200 mètres, in which case aim is taken at a point about two estimated men's heights below the foot of the object aimed at.

(2.) From 35 to 75 mètres, when aim is taken at a point only one estimated man's height below the foot of the object aimed at.

¹Up to 270 mètres the backsight is used without adjustment; between 270 and 350 mètres the flap of the backsight is used, and from 400 mètres and upwards the sight is adjusted according to the mark on the leaf. If the range to be fired at exceeds 400 mètres, the half-company leaders will name two distances at which the sight will be adjusted, one for the first and the other for the second rank.

30. The object of this is to sweep a greater depth of space by fire, as well as to neutralize any error in judging the distance.

Signals.

31. The bugle-calls sounded in action are—

Commence fire.

Advance.

Rapid advance.

Fix bayonets.

Form column of attack.

Alert (against cavalry).

32. Those sounded after an action are—

The battalion call.

The close.

Assemble.

33. A long-drawn whistle means—Pay attention to the leader and "Cease Fire."

34. A roll of the drum means—Halt. The beating of the charge means continuous advance.

35. A forward wave of the sword means—"Advance." Raising and lowering the sword means—"Halt."

Supply of Ammunition.

36. The battalion ammunition wagons remain about 1,000 paces in rear of the fighting line.

37. From these ammunition is sent forward in bags to the men in the fighting line.

38. Men who have to return to the ammunition wagon must be careful to note the road back.

The ammunition on the dead and wounded must, as far as possible, be collected.

The General Course of the Attack, of the Defence, and of the Stationary Fire Fight.

39. The object of an attack is to drive an enemy out of his position, and to compel him to retreat.

40. To effect this the enemy is approached at first at a rapid pace, then generally in rushes, with a view to shake him by fire at effective range.

41. The advance by rushes can be carried out either by a simultaneous advance of the whole line at the run for a certain distance, after which it takes up a fresh position, or by the advance of only a portion, under cover of the fire of the remainder.

¹ Note for the instructor:—

In firing at advancing infantry at 350 mètres the flap of the backsight may be used according to instructions; should the enemy's infantry, however, lie down within the distance at which the fixed backsight should be used, the firing would naturally be too high. It appears, therefore, best to use the fixed backsight up to 270 mètres at all objects except cavalry.

42. In small engagements individual soldiers may creep forward and try to approach the enemy's position.

43. At suitable distances, according to the nature of the ground (on an average 200 mètres), the fire is increased by word of command to rapid independent firing. After which, on the command or signal, bayonets are fixed, and the attack is delivered.

44. The attack consists of a rapid advance at the run (at long distances the first part is at the double, the last at the run), accompanied by the beating and sounding of all instruments, and loud hurrahs.

45. The attack may consist of—

1st. The attack by the fighting line.

2nd. The combined attack of troops in close formation and the fighting line.

46. When at the run, no more firing takes place, but when at the double, the ranks advance by alternate rushes and deliver their fire.

47. The object of the defence is to hold a position, the enemy must therefore be kept at a distance as far as possible by fire.

48. Should the enemy, notwithstanding, begin to charge, he must be opposed at the last moment with the bayonet. This is called the Counter-attack.

49. The infantry soldier must be a good, rapid judge of distance. He should be thoroughly practised in pacing the distance and marking it off.

50. He must be able rapidly to obtain cover with the spade. He receives a special training for this.

51. A "Stationary fire fight" is one in which the combatants remain under cover, firing at each other for a considerable time.

Infantry v. Infantry.

52. The fight between infantry consists in reality mainly of an almost continuous rolling musketry fire.

53. The soldier must make every effort to remain cool, notwithstanding the striking of bullets and the noise of the firing.

54. He must invariably take a distinct aim, and must never fire at random.

55. Also, in rapid firing, he should try to take a quick aim at some object.

56. The common object to fire at is usually the enemy's fighting line. Should nothing but its smoke be discernible, then the thickest layer should be aimed at.

57. If officers and mounted men can be distinguished, they should be fired at, but above all columns should be fired at.

58. At night, volleys and bayonet charges are delivered by companies in close formation.

Infantry v. Cavalry.

59. Infantry possesses a decided superiority over cavalry in action, both in single combat and in bodies, provided it remains cool.

60. Cavalry charges are delivered in échelons, *i.e.*, detachments following each other in rapid succession.

61. The important point is steady firing at short ranges.

62. With the sight adjusted to 400 mètres, and aiming at the foot of the object, the bullet will strike advancing cavalry throughout the distance of 400 mètres.

63. A fighting line occupying a favourable position will not close up to receive a cavalry charge, but will remain in the same, and direct its fire on the advancing cavalry.

64. Should the cavalry, however, approach to within 50 mètres, the fighting line will stand up.

65. This sudden standing up has the effect of startling both man and horse. It is, moreover, easier to aim standing at a mounted man than when lying down.

66. Fighting lines lying down in the open unprotected by any cover form up in line by half-companies, if they are not under a heavy fire.

67. When cavalry appears on the flanks, these are thrown back ; when in rear, the rear rank turns about.

68. The usual fire against cavalry is by volleys.

69. When all the ammunition is expended, rallying squares and squares are formed, and these fight with the bayonet.

70. Should a fighting line be really ridden down by cavalry, the men should throw themselves down, but they must jump up again immediately, assemble either in line or rallying squares, and fire after the cavalry or at the approaching cavalry échelons.

71. The infantry soldier must never surrender in a cowardly manner, and allow himself to be taken prisoner.

72. In single combat the infantry soldier allows the cavalry soldier to come up to within 30 mètres and then fires, in case he misses he fires a second time. Should he find himself without ammunition, he jumps aside as the cavalry soldier charges him and makes a thrust at his horse.

Infantry v. Artillery.

73. Artillery is either plied with volleys at long ranges, or better still, a point within short range of the flank of the battery is gained if possible under cover (*i.e.*, folds of ground, bushes, high-standing corn), from which independent firing is delivered. The battery is then charged at the run.

If the guns are on the move or on the point of limbering up, the fire is directed on the horses ; if they are in action, the object to be aimed at is the line of guns itself.

74. Rapid advances and diagonal movements are the best protection against artillery fire.

75. In case a battery has to be abandoned after having been captured, the removable part of the breech action is carried off.

The Conduct of Infantry during a Siege.

76. In this case it may occur that infantry has to remain, rifle in hand, in the parallels for days at a time in the presence of the enemy.

77. The individual soldier is then usually provided with 200 rounds and special rations.

78. It may be required to search a particular work in the enemy's lines with long-range firing of masses of troops.

79. The soldiers must in that case aim at the crest of the parapet, which usually stands out clearly, and particularly at the embrasures.

80. If a work has to be taken by assault, precise directions are issued beforehand as to the conduct of the skirmishers and columns, and as to the direction they are to take.

81. The most reckless bravery and the most expeditious crossing of the ditch alone can lead to the desired result.

82. On reaching the foot of the parapet the assailants halt for a moment for the purpose of forming, and then mount the parapet by means of the ladders, as well closed up as possible.

SPECIAL RULES FOR THE CONDUCT OF THE MEN IN ACTION, AND IN THE VARIOUS INCIDENTS OF THE SAME.

83. When the whistling and whizzing of bullets commences, let the soldiers

constantly bear in mind, even in the most perilous moment of the fight, that every sign of weakness is disgraceful and degrading.

84. It is strictly prohibited to attend to those who fall, dead or wounded.

It is better not to let the eyes rest on them. Men who are slightly wounded are not allowed to withdraw from the fight.

85. Wounded men coming out of the fight and returning to the rear must not dare to dishearten the reinforcing troops by expressions such as "Matters are going badly," or "You won't get off any better."

They must, on the contrary, put up with pain, and should strive to groan as little as possible.

86. Throwing packs away without orders will be severely punished.

87. Should prisoners be taken, none but those specially told off by the Commanding Officer are to take charge of them.

88. Whoever remains behind when marching into action is a dishonourable coward, and nothing but the severest punishment awaits him.

89. Whoever runs away from the fight, or induces his comrades to do so by shouts, or whoever throws away his arms, will be cut down forthwith by the nearest superior Officer.

90. Every soldier must strive to remain with his company, half-company, or group during the fight, as he cannot single-handed effect anything of importance. His concentrated attention must, therefore, be fixed on his leader.

91. Should a soldier, through no fault of his own, become separated from his company, he will join the nearest fighting body of troops and place himself under the orders of the Officer or non-commissioned officer in command of it, to whom he will render the implicit obedience due to his own immediate superiors.

92. Whenever bodies of troops become intermingled in action (which frequently is unavoidable), the superior Officer who assumes command is to be obeyed without hesitation.

93. The soldier must bear in mind that long-range firing rarely does much execution, and that its employment remains a matter of uncertainty; the leaders are responsible for the results obtained thereby.

94. Consequently, during an attack no firing must on any account take place at greater distances than 400 mètres unless it should be expressly ordered.

95. The soldier must, above all, remember to adjust his sights correctly. This is particularly necessary, as the half-company and group leaders are frequently put out of action, and the men are there and then thrown on their own resources.

96. Should the soldiers observe any movements or changes in the enemy's fighting line that may appear to him of importance, he must report them to his superior.

97. Every soldier must be able to convey an order clearly, and to make a clear report in the midst of the fight.

98. During the advance no man is allowed to hesitate or to halt, no matter how heavy the enemy's fire may be, or how severe the losses suffered. It is only when the Officer gives the command—"Halt,"—that a halt is made and a position is immediately taken up.

99. In closing on the enemy at the run, the advance must be continued without a check right up to the enemy's position. Should this not be done, and should the assailants run back, they are as good as dead, as they have to recross the ground under a murderous fire.

100. A determined charge really driven right home will invariably be successful.

101. If during the fight the enemy makes a determined forward movement, the principal thing is not to allow oneself to be intimidated.

Should some of the men lose courage and run away, they must be immediately brought back and encouraged by their comrades.

102. In the moment of danger the soldier must look to his leader, for he it is who orders what has to be done.

103. The enemy's attack must either be met with a withering fire, or he must be immediately charged.

104. Should the firing be so heavy that the orders of the Officers cannot be understood, attention must be paid to their signals with the sword, and to their personal movements.

105. When the enemy has been driven out of a position, the individual soldier must on no account rush on in pursuit, but must await the orders of his leader, and must in the meantime continue firing on the enemy.

106. The men must be able rapidly to reassemble after such an attack.

107. On the defensive, the men must be determined not to move from the position they are to hold.

108. Also in the attack it is not advantageous to fire at long ranges. The fire should be increased to the utmost from about 500 mètres.

109. The firing is commenced either by order or by signal.

110. The soldier should not allow himself to be intimidated by the enemy's shouts and close approach.

111. Every man should remain lying down and fire away steadily.

112. A position should not be evacuated except by a distinct command.

The enemy will not usually be able to withstand the firing of such a determined body of troops, but will run back.

113. Should the enemy, however, really come to close quarters, the men must be determined to engage him even hand to hand.

114. With equally good arms victory will generally fall to the combatant possessing the greatest courage and coolness, and the best discipline.

115. In close order, the rear-rank man must, above all, keep close to his front-rank man. His principal duty is to pay attention to the orders given, and carry them out accurately. He does not possess the independence of the skirmisher.

116. When the Officers and non-commissioned officers have fallen, every honourable soldier must strive to replace them. The lance-corporals, the oldest and ablest men, take command and lead their comrades on in the fight.

117. Should unfortunate circumstances and the decided superiority of the enemy compel a body of troops to fall back, no soldier must appear discouraged, or retire further than to the spot where the leader orders a halt, or to the pre-arranged place of assembly.

118. Should a soldier find himself separated from his corps after an action, he will proceed in search of it and rejoin it without delay.

All aimless roaming about on the battle-field will be severely punished.

Should a soldier have taken part in the fight in the ranks of another corps, he must carefully remember which it was, for the purpose of producing witnesses as to his conduct.

119. The soldier must behave in a noble and humane manner towards the enemy or prisoners. Under no circumstances whatever should their private property be taken from them, and they should never be ill-used without necessity.

120. The white flag with a red cross denotes dressing stations and hospitals.

A white band with a red cross worn on the arm denotes Medical Officers, bearers, &c.

These, in accordance with the Geneva Convention, are not to be fired on.

121. Firing off "Feu-de-joie" after the battle, plundering captured baggage or any similar misdemeanor, is strictly prohibited.

122. Furthermore, the soldier should be ready after an action, notwith-

standing his exhaustion, to start off in pursuit of the enemy should this be ordered, for it is only by a rapid and active pursuit that the victory is completed and further fighting avoided.

NOTICES OF BOOKS.

The Line of Communications. By Lieutenant-Colonel GEORGE ARMAND FURSE. London: Clowes and Sons. 1883. Pp. 239. Size $8\frac{1}{2}'' \times 5\frac{1}{2}'' \times \frac{3}{4}''$. Weight under 1 lb. 6 oz. Price 6s.

It will be observed that the author, apparently purposely, abstains from placing on the title-page any letters or words which would remind the reader of the official position he holds on the Headquarter Staff of the Army. Consequently this fact, taken in conjunction with the dedication of the book to the "Black Watch," indicates that the work must be regarded as putting forward the views and opinions of a private individual. The book is not the less valuable on that account. Army administration is a speciality with Lieutenant-Colonel Furse, and anything that he writes on the subject is sure to be thoroughly worth careful perusal, and in this instance he has placed before us in a clear and interesting manner a subject which ordinarily is, to say the least, somewhat dry and puzzling. Military and civilians alike will derive benefit from its perusal, the former in learning from it the principles on which should be conducted work in which at any time they may have to take part, the latter in learning the extent of the organization necessary to render an army an efficient fighting machine.—L. A. H.

Glossary of Navigation. A Vade-Mecum for Practical Navigators. By the Rev. J. B. HARBORD, M.A., R.N., Chaplain of the Fleet. Second edition, revised and enlarged. Portsmouth: Griffin and Co., 2, The Hard. London agents: Simpkin, Marshall, and Co. 1883. Pp. 421. Size $6'' \times 5'' \times 1\frac{1}{4}''$. Weight under 1 lb. Price 7s. 6d.

It is generally known that the modern naval Officer has to acquire a given amount of knowledge in a large number of subjects connected with the handling, fighting, and navigating his ship. It is tolerably certain that, however good his memory, there are times when, even in those subjects in which he may be strongest, reference must be made to a text-book of some kind. It is at such times that small handy volumes of reference, with exact information gathered from the larger works, and put in a form to quickly reinforce the memory, become so valuable.

One of the most recent contributions to this kind of book is that under review, which, in this edition, Mr. Harbord has considerably enlarged and improved. It contains explanations of the technical terms used in Nautical Geography, Meteorology, and Astronomy; hints to young Officers for systematic study; and information not generally accessible when wanted.

The Terms are arranged alphabetically, and the articles relating to those all-important instruments in Navigation, the Compass, Sextant, and Chronometer, are very complete and contain many hints useful to the Navigator, especially during his earlier essays in practical navigation.

In the articles on Nautical Astronomy, or "Celo-Navigation," as Mr. Harbord terms it in his book, it will be found that clear diagrams, with the necessary formulæ for ascertaining the Latitude, Longitude, and Azimuth, are given in preference to long rules. The author gives his reason for this at page 394, Term "Triangles, spherical": "There is no occasion for any verbal rules in navigation if the formulæ

for the solution of spherical triangles are remembered." Following this, the formulæ for spherical triangles are given in tables.

Under "Longitude," Sir G. B. Airy's new method of clearing the Lunar distance is added, in a convenient form and unabridged.

On the question of giving the derivation of the Terms, Mr. Harbord writes in his preface, page vii, "Those who consider this superfluous can pass them over; but I look upon them as valuable for several reasons * * * and they frequently embody its history in a manner both interesting and instructive." Many readers will no doubt appreciate this origin of terms as an aid to memory, and value the knowledge conveyed accordingly.

Among other new terms the author substitutes "Celo-Navigation" for Nautical Astronomy, and "Geo-Navigation" for Navigation. He considers that the term "'Navigation' has been dethroned from its rightful position," and "has simply been degraded by modern writers to fill a very subordinate rôle." He therefore proposes to restore the term to the place it held a century ago, and re-name the two great branches of it, as already mentioned.

Although Nautical Astronomy can hardly be called an exact term, or one directly conveying the full meaning for which it is intended, still long usage has so connected the term with the subject that the proposed change—received with due consideration, as it should be—will probably be but slowly adopted. Some navigators will prefer to find their handy *vade-mecum* in accordance with the original text-books.

Another new term, "even beam," used in connection with the heeling error of the compass, is clear and definite, with no formidable opponent to encounter.

The time has now arrived when any Officer, after passing his examination for Lieutenant in the Royal Navy, may be called upon to undertake navigating duties. He will no longer be disposed to "throw his old Gradus by," as did many of his predecessors, but will rather be glad to establish an intimate acquaintance with "a silent friend" and a trusty, as the "Glossary of Navigation" should prove to be.

—E. C.

Kriegsgeschichtliche Einzelschriften. Herausgegeben vom Grossen Generalstabe Abtheilung für Kriegsgeschichte. Heft I. Ernst Siegfried Mittler und Sohn. Berlin, 1883. p. 129. Size 9" x 6" x $\frac{1}{4}$ ". Weight under 11 ozs. Price 2s. 6d.

As will be seen by reference to the preface of this periodical, the Historical Section of the Great General Staff in Berlin has taken in hand the issue of incidental selections from the mass of papers which are to be found in the archives of that Department, in elucidation of individual phases, not only of the most recent, but of former wars. These selections will for the most part be taken from the collection of narratives of the more recent operations, specially such as relate to the employment and effect of the different arms, outpost and patrolling duties, the minor operations of war, fortifications, the maintenance and administration of armies. But it is by no means intended to exclude records of events connected with former wars, on which a wealth of information is to be found in the archives of the General Staff.

It is proposed that about three numbers shall be issued annually at a very moderate subscription, the price of single numbers being slightly increased to non-subscribers. Six numbers will constitute a volume.

The cost of subscription or of single numbers may be ascertained by reference to the foreign booksellers.

The present (first) number of which a second edition has already been issued, contains—

I. The Prussian preparations for war, and plans of operation of 1805.

II. The Detachment von Boltenstern in the Loir Valley, December, 1870.

To the student of history the first is valuable as throwing light on a somewhat obscure period, and as laying open the ideas leading up to the vacillating feeling of the Prussian King which culminated in the *débâcle* of 1806, the results of which are tersely summed by the concluding paragraph of the "Reflections" which close this subject, a liberal translation of which is as follows:—

"If the political events of 1805 teach us that a State which, at a period of great disturbance, only resolves to take actual part in war when no other choice remains open, not only forfeits the consideration of other Powers, but also the guarantee of its own safety, so much the more plainly do the military proceedings indicate the weakness to which that conception of the nature of war leads which seeks its decision, not in the annihilation of the enemy's power of resistance, but in the occupation of strips of territory, and in artificial combinations based on long previously thought out plans of operation, and on imaginative presuppositions."

But, if the first is valuable to the historical student, the second article should have a charm for the more frequent student of tactics, portraying as it does an incident of that eventful and instructive period of the war in France of 1870-71 which preceded the final advance of the Army of Prince Frederick Charles of Prussia on Le Mans.

The expedition of Lieutenant-Colonel von Boltensern in the Loir Valley on the 26th and 27th December, 1870, affords as good a tactical study as often comes before us.

His force—two battalions of infantry, a squadron, and one division of a field artillery battery—is such as may any day fall under the command of an Officer of similar rank in our Service. Happy will it be for the man who, in service of like difficulties, shows that power of distribution during the conduct of a very difficult advance, and that prompt resolution during a still more difficult retreat in the face of superior forces, which enabled Lieutenant-Colonel von Boltensern to extricate his column without any serious loss. We should but spoil the pleasure of the study by telling the story in detail.¹

There are two maps: one is a general map of the country embraced in the triangle Bourges—Chartres—Le Mans, the other shows the march of Lieutenant-Colonel von Boltensern in the Loir Valley, to which he was detached from Vendôme, at that date the most westerly advanced post of the 10th Prussian Army Corps.

Suffice it to say that, on reaching the defile of Troo, which was the limit of his advance, he not only found a superior force in his front, but, on his attempted return on his forward footsteps with the results of his reconnaissance, he found his flank menaced by another force at least ten times his superior in number, a large part of which was posted directly across both his lines of retreat. The whole narrative is most instructive. Clear perception of situation, and great resolution under what might have appeared to be overwhelming odds (on the part of the leader), thorough and unhesitating support (on the part of his subordinates), were the mainspring of his success, while not the least interesting portions of the narrative are those which depict the subsidiary incidents in which the younger Officers detached from the main column were involved.

If the promise of this first number is fulfilled in the future, which, from the well-known character of the work done by this branch of the Berlin General Staff, we see no reason to doubt, we believe that this series of publications will prove to be a very valuable addition to the library of the military student.—B. W.

Text-Book of Gunnery. By Captain G. Mackinlay, R.A. (Instructor in Artillery, Royal Military Academy, Woolwich). London: Printed under the superintendence of Her Majesty's Stationery Office. 1883. Pp. 192. Size 9 $\frac{3}{4}$ " \times 6 $\frac{1}{4}$ " \times $\frac{3}{4}$ ". Weight under 1 lb. Price 5s.

THIS work is the *Text-Book of Gunnery* at the Royal Military Academy, and is the successor to the "*Principles of Gunnery*," by Lieutenant-Colonel Sladen, which work is now out of print.

¹ We hope before long to put this story before those of our readers who are not familiar with German.—L. A. H.

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ADMIRAL LORD ALCESTER, G.C.B., &c., &c., in the Chair.

ON MASTING OF SHIPS-OF-WAR, AND THE NECESSITY OF STILL EMPLOYING SAIL POWER IN OCEAN- GOING SHIPS.

By Captain G. H. NOEL, R.N.

INTRODUCTION.

IN these days, when steam propulsion has attained such perfection, and is even threatened to be superseded by other motive powers, the question of the masting of ships-of-war may seem to those who claim to keep pace with the advance of science, somewhat out of date and wanting in importance; indeed it is sometimes openly propounded (and that by naval Officers) that masts are useless encumbrances, and ought to be wholly done away with. While admitting that masting should be modernized and rendered more suitable to the present conditions of ships, I am most strongly of opinion that the intention of ignoring such a useful and powerful element of propulsion as the wind is neither scientific nor judicious. My endeavour in writing this paper is to win back some of the wavering to a sounder faith in sail power, by pointing out how, with the modern scientific improvements in material of all sorts, the present system of masting can be rendered very much more efficient and serviceable, and by attempting to show that in ships-of-war, while certain classes can dispense with sail power altogether, to some classes it is useful, and to others indispensable.

Most naval Officers of experience still accredit sail power with a considerable degree of value; but it must be generally admitted that, in these days, when our ships are, on emergency, required to steam at great speed, improvements in the system of masting are urgently needed. Masting should be of such a nature that, while thoroughly serviceable for setting a large area of sail, it can be quickly, easily, and effectively reduced, when the ship is required to steam head to wind, or before going into action.

In treating of the masting of ships, the fleet should be divided into several distinct classes:—

- Class 1. Coast Service Ironclads.
- „ 2. Special Cruizers or Despatch Vessels.
- „ 3. Small swift Vidette Vessels.
- „ 4. Ocean Service Ironclads.
- „ 5. Armoured Cruizers.
- „ 6. Unarmoured Cruizers.
- „ 7. Small Coasting Cruizers.

These seven classes form three groups, between which we cannot draw too strong lines of demarcation, and this not only with reference to their masting, but also to their armament, speed, and many other considerations. It would be a great help to naval architects—who often have reason for complaining that too many good qualities are wanted in one vessel—if these distinctive groups were more fully recognized.

The 1st Group comprises Coast Service Ironclads of all sizes. The 2nd Group consists of Classes 2 and 3, Special Cruizers and Vidette Vessels of the greatest possible speed under steam. The 3rd Group includes Classes 4, 5, and 6, Ocean Service Ironclads and Cruizers, and to this group Class 7 may be here added.

As regards the masting of these Classes. Class 1, Coast Service Ironclads, need no sail power. They are vessels, as their name implies, intended for duty on the coast; they will seldom, if ever, be alone on foreign service, and should never be exposed to the risk of running short of coal. Their one mast is useful for signals and the working of machine-guns from aloft, both necessary matters in action.

Class 2, Special Cruizers, of which the “Iris” is a specimen. These vessels, having immense engine power, and possessing the utmost speed possible (for the purpose of carrying despatches or following up and capturing the enemy’s fastest cruizers), are necessarily of fine lines, and their speed under steam is such that square sails will avail them but little. Sail power is only requisite for steadying the ship, and in case of accident to the engines; good fore-and-aft canvas is here sufficient, and flying square sails on the foremast.

Class 3, Swift Vidette or look-out vessels, small craft of about 1,000 tons, possessing the highest speed under steam that is possible, subject to their being thoroughly fit for sea service; these vessels, required as tenders to the ironclad fleet, to move rapidly under steam, discovering and warding off the attack of torpedo boats, and otherwise keeping the look-out, would (like the special cruizers) only require light masting and fore-and-aft canvas.

Class 4, Ocean Service Ironclads, of which the “Téméraire” is a fair type, are required to cruise in open water, keeping the sea for long periods, perhaps at some distance from coaling stations, and where colliers cannot always be cleared, even if with the fleet. To this class sail power, though desirable, is not a matter of extreme urgency; their two masts, fully equipped in time of peace, would be useful for cruising purposes, and would serve to keep the men up to those duties so essential to seamen (especially when employed in cruizers where much

will depend on the seamanlike working of sails and spars); whereas, in time of war, the masting will be reduced as much as possible, and all light spars and rigging, used for other purposes, or landed out of the way. In action the lower masts are essential for observation, signals, and machine-gun fire. It may be anticipated that the time will come when this class will be merged in Class 5.

Class 5, Armoured Cruisers, of the "Nelson" or "Warspite" type, required for service on distant stations, where they would be usually unaccompanied. Such vessels are constantly taking long cruises entirely under sail; indeed their principal duty is cruising when the world is at peace, and the time is of less value than the health and exercise of their crews. In time of war their duty will be to engage the war-vessels of minor States, or the armoured cruisers of a maritime Power, like themselves in build, and also far from their own ports. It will be more than ever necessary to economize coal on these services; the sail power should therefore be most thoroughly efficient, the masting of dimensions suitable for spreading a large area of canvas, and since it is most necessary that when occasions require they should be capable of steaming with great rapidity against the wind, it should be possible to reduce the spars and rigging (offering resistance) quickly and to the utmost extent.

Class 6, Unarmoured Cruisers of 1,500 tons and upwards. Since it is imperative for all such cruisers to have the heels of larger and more powerful vessels in open waters, this class should be even more fully rigged, in proportion to their tonnage, than the armoured heavier cruisers; their speed ought to be materially assisted by sail power, so as to secure their escape from a powerful adversary, under steam and sail (in the direction in which the wind would most help them), and to enable them to economize fuel at all times by cruising under sail; or these vessels active and experienced seamen are more than ever wanted, and the smartest possible evolution will be requisite in preparing to steam head to wind for a chase, and in replacing everything for making sail again.

Class 7, Small Coasting Cruisers, of 800 to 1,500 tons, like the larger ships of this type, should be amply rigged. Their principal protection against powerful vessels is the lightness of their draught; speed under steam is not of great moment, but their sail power should be such as to admit of their making good passages from port to port, principally under canvas.

This is a general outline of the requirements of these seven classes of ships-of-war. Masting is considered—in Group I only requisite for signal and machine-gun work; in Group II for steadying the ship, and in case of accidents; and in Group III for spreading a large amount of canvas, which (for this group) is considered essential.

PART I.

Arguments for and against Sail Power.

In dealing with these arguments we shall do well first to accurately ascertain what is being done in our fellow service, the Mercantile

Marine. Through the kindness and courtesy of some of the leading ship-building firms, and owners of the principal lines of steamers, I have been able to collect evidence and opinions on the systems of masting adopted by a considerable number of those companies whose magnificent steamers are unequalled in the mercantile world, and of the possession of which this country may well be proud. The main features of this evidence are as follows :—All the firms agree that sail power is necessary for the purpose of steadying the ships, and in case of accident to the engines, and that masting is useful for taking in and discharging cargo. Five of the principal companies, namely, the “White Star,” “Inman,” “Royal Mail Steam Packet Company,” “Dominion,” and “British India” lines are in favour of sail power as assisting the passages of their steamships; other firms are opposed to it, while some remain neutral on the question. The “Guion” Company, the speed of whose new steamers is seldom beaten, and also the “Allan” line across the Atlantic, do not value sail power, nor does the Ocean Steamship Company, though this last send their vessels to distant parts of the world. The “Cunard,” “Orient,” “National,” “Castle,” and “Union” lines, and the Pacific Steam Navigation Company admit that sail power has some value; for instance, the “Orient” steamers find the benefit of their sails in southern latitudes, between the Cape and Australia. The vessels of this line are very fully rigged, and those of the other five are serviceably rigged. It is undoubtedly the fact that with steamers of great power and very considerable speed, square sails are of little or no use. The speed these vessels keep up is such that the wind is seldom brought abaft the beam. Hence it is that fore-and-aft sails are those on which they must depend for assistance in steadying the ship, and perhaps in some cases adding to the speed, or at any rate reducing the expenditure of fuel. Some of the older companies still adhere to the three-masted rig, but a great many modern steamers in the Mercantile Marine carry either four or two masts, according to their length. Those of the most improved pattern are pole-masts, often without tops or cross-trees; the yards on the masts forward are in some cases sent down for the part of the passage where head-winds are expected, and in one or two lines they are only intended to be crossed in case of accident to the engines; gaffs are also sometimes dispensed with as holding wind unnecessarily. It will be understood from this statement that every endeavour is made to reduce top hamper and resistance to the wind to a minimum, and yet to show a fair spread of canvas when it is needed. The area of the canvas carried by some of the principal merchant steamers will be found in Table II, page 15. Except by one or two firms no reduction is anticipated in the present amount of sail power; this question might be affected by the introduction of twin-screws, but apparently there is no idea of departing from the single propeller system of propulsion.

The particulars I have received have principally reference to steamers of full power, intended for mail and passenger service; where the power is not so great, sail becomes of more value, and if it were not for the fact that economy necessitates the keeping down the number of

the crew of such steamers, the spread of canvas would in all probability be still greater. Another element which curtails the sail area in merchant vessels is the variation in the weights of different cargoes. A steamer in light draught is often too unstable to carry canvas with safety, and it is not worth her while to take in ballast to give her the necessary stability. The light draught displacement of a merchant vessel is sometimes only 30 per cent. of that at load or deep draught. The light draught displacement of a ship of war is never less than 80 per cent. of the load displacement, and is usually about 90 per cent.

Comparing the two services, in the Mercantile Marine the one great aim and object (especially with mail steamers) is to make good passages, obtaining the highest speed for the least expense. These vessels keep up the same rate throughout the voyage, sometimes making an average of 360 miles a day, while, with ships-of-war, a long passage at great speed is an exceedingly rare event. Though it is of course necessary to be careful with fuel, there is no risk of merchant steamers running short, as they take in ample to carry them to their destined port or next coaling station; whereas with a ship-of-war, economy of fuel is of the most vital importance, as there is seldom any definite route for her to take, and when least expected she may be ordered off on some special service, where there may be no certainty of obtaining coal. In merchant steamers the crews of seamen are not large enough to effectively work the sails, that is, so as to take every advantage of the wind; on the other hand, the crew of a man-of-war is, or should be, sufficient to work whatever spars and sails she may be provided with, whatever their dimensions. The variations in weights of cargo curtail the power to carry sail in merchant steamers; in a man-of-war this variation is comparatively of little moment.

The conclusions to be drawn from these comparisons are that while the experience of our fellow service is most valuable to us, and many of the improvements in the material and construction of their gear and appliances and the working of their sails may be with benefit introduced into our navy, the general system of masting in the Mercantile Marine is only applicable to our special cruisers, despatch, and vidette vessels, and that we must not be guided by the experience of rapid steamers in deciding on the masting requisite for such of our ships-of-war as are essentially required for cruising purposes, though possessing the power of steaming at considerable speed on an emergency.

Having decided that sail power is not required in Group I; that sails similar to those in the fast steamers of the Mercantile Marine are all that is requisite for Group II; we have now to deal solely with Group III, comprising all classes of armoured and unarmoured sea-going ironclads and cruisers; what are the arguments for and against providing this group with effective sail power?

Firstly, as regards the resistance to the wind offered by masting. The only argument of any weight against sail power is that the spars offer great resistance to the wind when steaming against it. No doubt this resistance is very considerable. The late Mr. W. Froude estimated

that in the "Greyhound," a somewhat fully rigged vessel with wooden masts, and nearly all her rigging of hemp, the resistance offered by the masting was equal to that offered by the hull (that is, to the mid-ship transverse section of the hull above water), about 330 square feet. The introduction of recent improvements in material, together with sending down upper masts and yards, should reduce this number to at most 250 square feet, and the further improvements proposed later on in this paper, to about 200 square feet. The estimated resistance offered by a surface of *one* square foot moving through air at the rate of 1 foot per second is .0017 lbs., and (since resistance varies as the square of the velocity) this would give a resistance of 1 lb. for every square foot moving through the air at the rate of 15 miles an hour. Hence, if the masting of H.M.S. "Greyhound" improved as proposed, and reduced for steaming head to wind, only represented 200 square feet, passing through the air at the rate of 15 knots, she would experience a resistance of only 200 lbs.; this would of course increase rapidly with the rate at which the air passed the ship, until at 80 knots we find the resistance is over $2\frac{1}{2}$ tons. Experiments are very much needed in order to obtain more definite data on the subject of the resistance offered by masting, and it is to be hoped that they will be some day carried out.

The funnels of powerful steamers offer considerable resistance; they serve to shelter the after-masting when steaming head to wind, which lessens to some extent the resistance offered by the main and mizen masts.

Another consideration is, that as at least one lower mast is essential for what are now called military purposes (that is, observations, signals, and machine-gun fire), a certain amount of resistance due to masting has to be overcome, why should not this necessary evil, when under steam alone, be made good use of, when the wind will help, especially if by ingenious appliances you can at will reduce the useful masting, until it offers little more resistance than a mast intended merely for military purposes?

Secondly, on the general duties of cruisers. From the outline already given of these duties it will be understood that cruisers should be capable of making very good passages under steam and sail: either in order to take up their post on a foreign station, to move to any threatened point, or for the purposes of a convoy. Long passages at high rates of speed will be of rare occurrence; of course occasions may arise when it will be necessary to send a ship-of-war or two, or even a squadron, to some distant station where our interests may be threatened; perhaps some unexpected event necessitating a reinforcement. In such a case, if the vessels required are not merely special cruisers, intended for like rapid movements, but something more substantial, the emergency must be met by attaching colliers to the squadron, or if they are not available, by filling the ships themselves with coal, in every hole and corner where it can possibly be stowed. Where judicious precautionary measures are taken, it will be seldom necessary to send ships-of-war to distant stations at great speed, and even if such a necessity should arise it would be no use their appearing

at the place of danger with their bunkers empty (which must result from a long steam passage), and unaccompanied by colliers. In addition to the ordinary duties of cruisers when on their station, will be that of cruising off and guarding neutral coaling ports in time of war, to prevent any of the enemy's vessels entering and obtaining coal; on which service they must be attended by vidette vessels of great speed, for searching out the enemy's ships, and putting their comrades on the scent. As regards convoy duties, ordinary cruisers should be capable of effectively convoying cargo steamers of moderate speed, such as those vessels that bring our food supply, which may require heavily armed protection. Our fast mail steamers will be able to take good care of themselves; and should the enemy send rapid vessels against them, special cruisers must hunt such vessels down: in some cases it will be sufficient if armed merchant steamers of great speed form a convoy for their consorts. For all these duties I maintain that effective sail power is necessary, and that to substitute the weight of the masting for an additional weight of fuel, would in no way render cruisers more serviceable.

Thirdly, on economy of fuel. With respect to cruisers in time of war, this question is of all others the most important. A system by which ships are so masted that coal is economized and sail used is, I am convinced, preferable to the opposite theory of expending coal on all occasions, and meeting this expenditure by making men-of-war their own colliers, to do which you must either construct enormous ships, or, if they are of moderate size, cramp all your internal arrangements and sacrifice the speed of your vessel, when in all likelihood her very existence may depend on that speed when the time of action comes. Increase of coal-carrying power means the cramping of other stowage, reducing the space for the engines and boilers to a minimum, giving the ship an amount of consumable stores which are very inconvenient (detracting from her speed when full, and from her safety when consumed), the stowage or rather the moving of which interferes with the efficiency of the watertight compartments, and after all if coal is to be the sole agent of propulsion, it is impossible for an ocean service ship-of-war to carry sufficient! Where economy of fuel is effected by the use of serviceable sail power great coal-carrying capacity is less important; the same steaming speed ought then to be attained with vessels of more moderate dimensions, and the ship's movements and safety will not depend solely on her ability to obtain coal.

One of the strategical principles in the naval warfare of the future will be starving the enemy out of his coal. Coaling stations will be seized and held, or the coal destroyed. Where then will that vessel be whose only means of propulsion and life comes out of her coal bunkers, when such a mishap occurs to her as to arrive with coal expended at a port coalless, or in the enemy's hands? She will be helpless either to fight or to fly; a well-masted vessel would have good chance of being able to do either one or the other, for with economy her coal would not be short, and even if it were so, her sail would be helpful in supplying the deficiency. Does not the best policy appear

to be so to rig our cruizers that they can take good care of themselves under sail, keeping steam as a reserve, to be used when the enemy is in sight, or for a quick passage where there is a fair certainty of obtaining coal at its end? Captain Colomb, R.N., who I am afraid is one of my opponents on this question, in one paper read at this Institution, April 15th, 1878,¹ proposed the almost entire abolition of sail power; but then in his Prize Essay of the same year he joins our system of communication in war time with no less than 75 coaling stations, 25 of which are not in our possession, and most of the remaining 50 are not fortified or protected in any way. When these important positions are *all* under our flag, and are *all* rendered practically secure from capture or destruction, we may reasonably trust our ships abroad without sail power, though even then it may be often attended with great risk or inconvenience. For instance, a mastless vessel, with just sufficient coal on board to reach her destined port, would not dare attempt the passage, and perhaps might have to retrace her route, or go considerably out of her way to replenish her bunkers; whereas a masted vessel, under similar circumstances, would proceed confidently on her voyage. We sometimes hear it suggested that there would be great economy effected by doing away with masts and sails, and substituting for the weight so saved an extra amount of coal. From Table I it will be seen how little there really is in this suggestion. Of the weight given for the spars and rigging of the "Alexandra," only 186 tons in all, what with the necessary one mast and its top-mast and rigging, tackles, &c., there might be a saving of 120 tons: this, if devoted to coals, would enable the "Alexandra" to steam at full speed for about sixteen hours, or 240 miles.

¹ "Steam-power *versus* Sail-power for Men-of-War." "Journal R.U.S.I.," vol. xxii, No. XCVI.

TABLE I.—*Showing Weights of Coal and Masting on board various ships.*

Ship's Name.	Tons Displacement.	Coal capacity.		Masting.		Approximate weight of a single mast and necessary gear.	Saving which might be applied as fuel.	Distance for which additional fuel would enable ship to steam at full speed.	Remarks.
		Weight.	Fraction of displacement.	Weight.	Fraction of displacement.				
		tons.		tons.		tons.	tons.		
Alexandra ..	9,490	680	·072	186	·02	66	120	16 hours at 15 knots or 240 miles	} complement of coal } 500 tons.
Nelson ..	7,630	1,150	·15	175 approx.	·023	60	115	18 hours at 14 knots or 252 miles	} " } 540 "
Shannon ..	5,390	560	·104	159	·029	49	110	34 hours at 12 knots or 408 miles	} " } 280 "
Inconstant ..	5,780	680	·115	171	·03	61	110	15 hours at 16½ knots or 248 miles	} " } 680 "
Bacchante ..	4,130	500 estimated	·12	141	·034	41	100	18 hours at 14 knots or 252 miles	} " } 400 "
Canada ..	2,380	470 estimated	·2	82	·034	22	60	25 hours at 13 knots or 325 miles	} " } 270 "

In this table expenditure of coal has been taken at 2·24 lbs. per I.H.P., it being a reasonable all round measure with coal obtained abroad.

I contend that if, say, '15 of the displacement is to be devoted to elements of propulsion, it were better to devote '12 to fuel, and '03 to masting, than to have no sail power and '15 of displacement in coals.

Fourthly, on the value of sail power. It will not, perhaps, be out of place here to say a few words on this subject, as the rising generation of naval Officers, who have had little or no practical experience in the sailing of ships, are inclined to doubt the value of sail power. From want of experience a feeling of contempt is growing up for this mode of propulsion, especially in the more scientific school, which includes some of the most promising of our young Officers.

As an instance of the value of sails we have a passage, made in the spring of 1842 by H.M.S. "Vindictive," from off the "Start" to sighting "Java Head," in the Straits of Sunda, a distance by sailing passage of 12,600 miles, in 67 days 15 hours, or an average of 187 miles a day; on 34 days she accomplished over 200 miles' run per day, on 14 days of which, the run was over 250 miles per day, the two best runs being 295 and 296. Sail in this passage may be fairly estimated as having done the work of 500 I.H.P. with the latest improvements in engines, and a probable expenditure of about 800 tons of coal. There are numberless other instances of splendid passages under sail, notably those of the Australian clippers and of the tea-clippers from China, a very good article on which is to be found in "Naval Science," 1873. The management of a ship under sail when making a passage is most truly a science, and by its proper application sail power can be rendered of very great value. Is it because the science of profitably using the wind is being lost in our service that the present age is anxious to prove its ability to do without so powerful a motive agent? Before the days of steam, passages under sail were minutely studied, and with results such as those referred to above. The introduction of steam disturbed the old calculations, at the same time bringing about a laxity in the exceeding watchfulness and care necessary for success in sailing passages, and, either because the merchant service have never made much use of sailing ships with auxiliary engines, or because men-of-war passages are often indefinite in their aim and precision, we do not seem ever to have had the necessary calculations made, or the question of "steam-and-sail" passages thoroughly worked out and studied; though meteorological and hydrographical information is more perfect and concise than it ever was. The result is that our present ships-of-war, though they have steam to help them, often make worse passages than the old sailing ships. I have great faith in the possibility of making most excellent *steam-and-sail* passages; but they will demand, on the part of the Officers, the same constant care and attention that a good sailing passage required (which means that every breath of wind should be taken advantage of), combined with the closest study of wind charts, and the most judicious use of steam.

There is a growing impression that it is impossible for a good sailing vessel to be at the same time a good steamer. Like the question of *steam-and-sail* passages so it is with the construction of man-of-war cruisers—we have not given it a fair trial. No real attempt has been made to combine good sailing with good steaming qualities since

the building of the "Inconstant," which vessel, except for her being somewhat crank, answered both purposes most admirably. The late Mr. William Froude pointed out very forcibly that the form of vessel which offered least resistance, and consequently was best for attaining speed under steam, need not be of great length in proportion to beam, so long as it possessed fine entrance and run. Mr. J. H. Byles brought this subject up only the other day in a paper read at the Institute of Naval Architects, and clearly showed that in the construction of merchant steamers this theory was borne out by practice. I think it has yet to be proved whether on this principle a vessel could not be constructed which would combine steaming and sailing qualities to a higher degree than anything that has yet been produced. There is no doubt that such qualities as good beam and fine ends carry with them every advantage a man-of-war most needs—namely: engine space, coal space, stiffness under canvas, handiness under steam, security of vital parts, and deck-room for working guns and spars. The only difference which appears to me to be requisite in the forms of two ships, one intended only as a steamer, and the other for sailing as well as steaming, is that in the first case it is necessary that her lines should be such as will offer small resistance when on an even keel, and in the second case her lines should have a similar effect, both when on an even keel and when heeling. In the sailing steamer the fineness of the entrance and run would probably have to be worked in more horizontally than vertically, obtaining the same co-efficient of fineness as in the steamship, but giving the vessel greater stiffness under canvas. In armoured vessels the tendency has of late been to increase the beam, and also to dispense with much of the upper weight of armour, such as box-batteries, and armour round the gun-deck: both these tendencies are in favour of a ship's sailing qualities.

In all cruising vessels it will be necessary either to lift or feather the screws; this latter method has lately received the attention of several ingenious engineers, and we may shortly look for its being perfected. Where twin-screw propulsion is adopted lifting the propellers is out of the question.

Fifthly, on the numbers, efficiency, and discipline of the crews.

Since employment can be found for the men there is no reason why the crew of a war-ship should not be sufficiently large to work with ease *any* masts and sails that can possibly be put into her, and that with such effect as to obtain their full value in making a passage. In the present age, when ships are more costly, and consequently fewer than before, there is every reason for keeping the crews up to a high numerical standard. The seamen of the regular service are such a mere handful compared with the numbers of regulars employed in the principal military services of the Continent, that England may well afford to keep that handful up to its full number and efficiency. If we allow seamen and seamanship to fall into disrepute we may construct the most perfect fighting machine the world ever saw, but we shall have no one to fight it. In the days of sailing line-of-battle ships the crews were numerically very strong, in order to work the guns and the sails at the same time. The introduction of steam had the effect of

reducing the crews to the numbers required for working the guns and the engines. Improvements in the method of working the guns caused a still further reduction, and these improvements still developing with the assistance of steam and hydraulic power (which are also employed in nearly all the work of the ship) have advanced until we now find the "Dreadnought," of 10,800 tons displacement, with a complement of only 369 Officers and men. There is no great harm in carrying the reduction in numbers to this minimum in mastless vessels, intended for coast service, to be commissioned when there is a threat of war, and which probably will be only manned periodically (from barracks when we get them) for a few weeks together in peace time for purposes of exercise. But in our ocean service vessels which we *must* keep in employment, prepared for duty or action at the shortest possible notice—sometimes to send a large landing party or a flotilla of boats away, sometimes to organize a torpedo attack or (as in the case of the Sea of Marmora) to put out defences under cover of darkness, against torpedo boats, and to keep the most vigilant look-out, large and well-trained crews are a positive necessity. Complaints are sometimes made that these vessels have not sufficient accommodation for their crews; considering the comparative increase in size, and reduction in the complement of recent ships, there can be no real reason for this, though perhaps in some cases it may be necessary to use forced ventilation, and to berth part of the crew in the compartments below. Under any circumstances it can never truly be said that our ocean-going ships-of-war are not able to carry a sufficient number of men to efficiently work the masting, especially in these days, when improved appliances so greatly facilitate the handling of spars and sails.

At one time the navy of England predominated over the navies of all other nations, because (though our squadrons were often inferior in speed and power to those of the enemy) the crews of our ships were composed of such excellent seamen, and the ships themselves were so admirably handled. Steam has been a marvellous equalizer: any nation, with money to spend on her navy, can now construct or purchase ships-of-war, and claim to hold an important position among the naval armaments of the world. But there is still a strife among maritime nations, in which there will probably be found as much difference between the competitors, when put to the test, as there was in bygone days: that strife is for the mastery in seamanship, pre-eminence in which can only be attained by the most careful and attentive study, combined with experience, and nature's endowment of those seamanlike qualities through which our forefathers so greatly excelled. Seamanship—in the sense of *experienced and masterly knowledge of how to manage a vessel under all conceivable circumstances*—for the Officers, to enable them, with coolness and confidence, to take their ships into action; to manœuvre with precision, to intuitively foresee and frustrate any scheme the enemy may adopt, with judgment and celerity to take the right steps in accident and disaster, to be in fact fully cognizant of all and every duty they may be called upon to perform in the most extreme emergency. Seamanship—in the sense of *intelligent activity and adroitness in the management and manipulation of all matters*

appertaining to a seafaring life—for the seamen, who are more than ever required to be active, cool, and daring, accustomed to danger, steady, and under discipline. All the recent improvements in weapons call for these qualities in the highest attainable degree, and especially since ships under steam at great speed will do small work with their guns and torpedoes, unless those weapons are handled with the utmost smartness, while for service in cruisers, the smartest possible working of sails and spars will be requisite in preparing for an action or a chase. The training of Officers and seamen, so that they may attain true efficiency in the science of seamanship as above described, can only be thoroughly conducted by constant service at sea in masted ships, combined with plenty of boat work, and occasionally a period of practice in the management of a coast service ironclad in cruises from the port at which she is stationed. The discipline of a ship's company can only be firmly maintained where there is sufficient work to employ the men, and this is best accomplished when a considerable part of the employment is of an evolutionary nature, emulated by competition, requiring a great display of energy, and the strictest and most intelligent attention to orders. Masting, in addition to its value in other respects, is the best means of keeping the men in healthy employment of mind and body, and all the qualities conducive to good discipline.

In the arguments for and against the masting of ocean-going cruisers, which have been treated in this part as fully as the length of the paper will admit, it has been shown that of the two objections to supplying those vessels with sail power, viz., the weight of the masting, and the resistance it offers when steaming head to wind, the first has been proved to be very small when compared with the displacement, and the last is considered capable of being very much reduced by improved appliances. While in favour of masting we have the considerations (provided it is efficient) that sail power economizes fuel, helps the vessel in making a passage, enables small vessels, by augmenting the steaming speed, to escape more powerful adversaries, and it employs Officers and men in such work as will especially develop in them those qualities above all others necessary for managing and fighting their ship—intelligence, vigilance, activity, and discipline.

PART II.

Proposed System of Masting.

In dealing with this part of our subject there are three principal matters for consideration:—

1. The area of canvas it is desirable each class of vessel should carry.
2. How that canvas is best spread.
3. What improvements can be introduced in the means of spreading canvas, so as to render the masting not only efficient for this purpose, but also serviceable for steamships where it is advantageous that the resistance offered to wind by spars and rigging should be reduced to a minimum when occasions require.

First, as regards the area of canvas to be carried. The comparisons between the sail areas in different vessels have been calculated by various methods. We will here adopt the most recent, which is also the method particularly applicable to ships-of-war,¹ that of comparing certain results, the result for any given ship being obtained by dividing the area of plain sail in square feet by the displacement to the power of two-thirds, or $\frac{A}{(D)^{\frac{2}{3}}}$, a method intended to put the sail area of all vessels nearly on an equal footing, whatever their displacement. With reference to merchant vessels this formula is not so suitable, as their sail power cannot be fairly calculated in its relation to deep draught displacement, and yet there is no other means of effecting a comparison with ships-of-war, if this enormous and uncertain measure be not taken. Hence, the number representing the sail power of a merchant steamer is very small as compared with that of a man-of-war. See the following Tables, II and III.

¹ Mr. W. H. White, in his *Manual of "Naval Architecture,"* chap. xii, on Sail Propulsion, gives a great deal of valuable information on this subject.

TABLE II.—Area of Sail, &c., of some of the principal Steamships of the Mercantile Marine.

Company.	Name of Ship.	Tonnage.		Area of Plain Sail. A	Area of Sail. (Displacement.) $\frac{A}{2}$ or $\frac{A}{D} \frac{2}{3}$	No. of Masts.		Remarks.
		Gross.	Load Displacement. D			Total.	No. square rigged.	
White Star Line ..	Britannic ..	tons.	tons.	sq. ft.		4	3	
		5,004	9,600	19,527	43.3			
Inman Line ..	City of Berlin ..	5,494	9,850	20,224	44.0	3	3	
Dominion Line ..	Vancouver ..	4,841	9,712	17,795	39.0	4	2	
British India Line..	Dacca ..	3,908	4,500	15,282	56.0*	2	2	* Load displacement should probably be greater, and consequently this No. less.
Guion Line..	Alaska ..	6,932	11,465	22,295	43.7	4	2	
Allan Line ..	Parisian ..	5,359	9,600	15,244	34.0	4	2	
Orient Line ..	Austral ..	5,588	{ about 10,000	28,092†	60.4	4	2	† This probably includes stay sail.
Cunard Line ..	Servia ..	7,332	12,600	{ about 17,700	32.5	3	2	
National Line .	Egypt ..	4,669	9,500	{ about 18,000	{ about 40.0	4	2	
Union Line..	Athenian ..	3,877	6,425	18,958	55.0	3	1	Area of sail probably includes stay sails.
Pacific S. Nav. Co. ..	Iberia ..	4,666	{ about 9,000	13,185	30.04	3	2	

TABLE III.—Area of Sail, &c., of the undermentioned Ships-of-War.

Class.	Name.	Tons Displacement. D	Area of Plain Sail. A	$\frac{A}{D^{\frac{2}{3}}}$	Rig.	Remarks on sailing qualities.
Sea-going ironclads ..	Alexandra	9,492	22,960	51.21	barque	sails fairly.
	Hercules	8,592	28,800	68.65	ship	sails well.
	Ténéraire	8,464	24,920	59.65	brig	sails fairly.
	Triumph	6,640	22,752	64.26	barque	sails well.
Armoured cruisers ..	Nelson	7,566	24,766	64.26	"	sails fairly.
	Warspite	7,390	20,575	54.23	brig	not complete.
	Shannon	5,405	21,580	70.07	barque	sails fairly.
	Inconstant	5,782	26,034	80.81	ship	sails very well.
Unarmoured cruisers, recent and new ..	Bacchante	4,130	18,805	73.05	" "	sails well.
	Active	3,080	16,593	78.38	" "	"
	Calypto	2,765	16,580	84.16	barque	not complete.
	Canada	2,383	14,152	81.34	"	C class. Sails fairly.
	Opal ..	2,144	13,106	78.8	ship	sails well, but too crank.
	Caroline	1,420	10,610	84.0	barque	not complete.
	Cornorant	1,124	9,942	91.97	"	sails well.
	Iris ..	3,735	12,957	53.82	barquentine	"
	Arethusa	3,748	14,307	59.3	"	not complete.
	Immortalité (1861)	3,690	25,640	107.37	ship	sails very well indeed.
Special cruisers	Rinaldo (1861)	1,200	12,630	111.85	" "	sails very well.
	Ganges (1852), 84 guns	3,594	27,734	117.93	" "	"
	Paeton (1849), 50 guns	2,630	24,267	127.36	" "	sailed very well indeed.
	Vindictive (1842), 50 guns	2,585	24,595	130.58	" "	"
" corvette, or 6th class frigate	Vestal (1849), 28 guns	1,030	14,372	140.91	" "	"
	Espiegle (1844), 12 guns	465	9,989	166.43	brig	"
	Thermopylæ (1868) ..	1,970	17,520	110	ship	very well indeed.
	China clipper ..					"

TABLE IV.—*Proposed Area of Sails for different classes of Ships-of-War.*

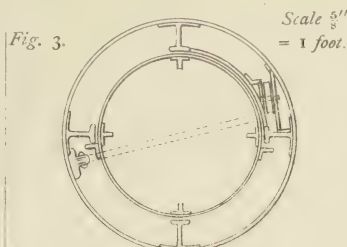
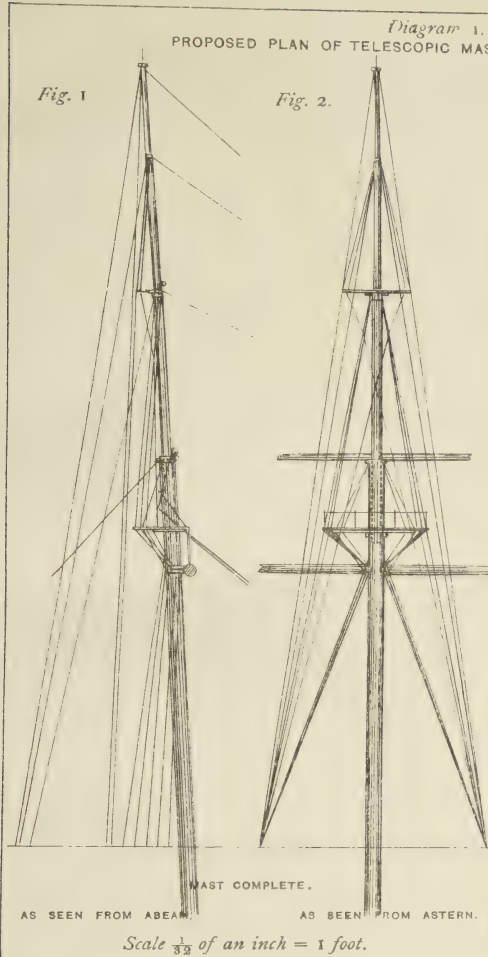
Group and Class. (<i>Vide</i> page 544.)	Description of Ship.	Tons Displacement. D.	Area of Plain Sail. A.	$\frac{A}{D^{\frac{2}{3}}}$.	Rig.	Remarks.
Group I. Class 1 ..	Coast Service Ironclads	tons. 10,000 to 5,000	sq. ft. —	—	1. (Military).	
{ Class 2 ..	Special Cruisers ..	3,500	10,000	43.5	Barquentine.	
{ Class 2 ..	" ..	2,500	8,000	44 {	3-masted top-sail Schooner.	
{ Class 3 ..	Vidette Vessels ..	1,000	5,000	50	Top-sail Schooner.	
{ Class 4 ..	Seagoing Ironclads ..	8,000	22,000	55	Brig.	
{ Class 5 ..	Armoured Cruisers ..	7,000	25,000	68	Barque.	
{ Class 5 ..	" ..	5,000	20,500	75	"	
{ Class 6 ..	Unarmoured Cruisers ..	3,500	19,500	85	Ship.	
{ Class 6 ..	" ..	2,500	16,400	90	"	
{ Class 6 ..	" ..	1,500	12,700	95	Barque.	
{ Class 7 ..	Small Coasting Cruisers	1,000	10,000	100	"	

Table II gives the comparisons of the area of plain sail for mail and passenger steamers by the method described $\left(\frac{A}{D^{\frac{2}{3}}}\right)$; it will be seen from this table that the sail power of the largest steamers of the Mercantile Marine averages about 40, and those of more moderate size about 50. Table III gives the relative sail power of present and past ships-of-war, showing how much the power has of late years been decreased; this is a necessity in very large vessels, and may be partly on account of the superior fineness of the lines in the smaller vessels. Table IV shows the proposed area of canvas and the rig for the different descriptions of vessels, as classed in the introduction to this paper; it is principally compiled from the two preceding tables, and it will be seen that while coast service ironclads carry no sail, special cruisers only carry fore-and-aft canvas, and a light square rig forward, whereas sea-going ironclads carry much the same sail as the "Téméraire" and "Warspite," and armoured and other cruisers have a slight increase on the present vessels of their displacements.

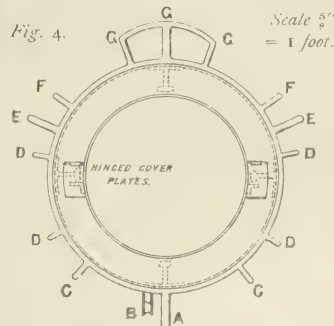
Secondly, as to what is the best method of spreading the canvas. In the actual manner of setting a ship's sails, little improvement has been made since the taunt, tapering masts, and square yards of the end of the last century (for his great attention to the efficiency of which the then Sir John Jervis obtained much deserved credit). Of late years some minor alterations have been attempted in the setting of sails (such as patent reefed top-sails), but have obtained no permanent hold in the Royal Navy, where there are plenty of hands to work ordinary sails. Double top-sail-yards (and even top-gallant-yards) have been introduced largely into the sailing merchant shipping, an admirable invention, where the weight and resistance of spars are of comparatively little consequence, especially for short-handed vessels.

In the navy, though improvement in material is much wanted, there is small need for alteration in the general arrangements for setting sail; we may therefore decide that for our ocean-going cruisers masts and yards giving a similar means of spreading canvas to those in the last of the wooden frigates and smaller vessels, is still required; a lesson may, however, be learnt from the clipper ships, and greater squareness given to the upper yards, especially to the top-gallant-yard, which (I suppose for purposes of evolution) have always been short, spreading a very small top-gallant-sail, as compared to the sailing ships of the merchant service. Top-gallant studding sails can be dispensed with in large vessels, but would still be useful in the smaller classes; top-mast studding sails are indispensable for good passage where single top-sails are used (which must necessarily be somewhat narrow), and, having the booms, of course lower studding sails can be set. For special cruisers, barquentine rig, and for the smaller vessels of this class two or three masted top-sail schooner rig, or something corresponding to the masting of the mail and passenger steamers of the Mercantile Marine, is very suitable.

Thirdly, with respect to the actual construction of masts and yards, the plan on which they should be rigged and worked, and the gear for handling sails.



Section of mast and heel of topmast



Plan of lower masthead.

REFERENCE TO FITTINGS AT MAIN MASTHEAD.

- A. Cap backstay.
- B. Mizzen topmast stay.
- CC. Lower buntlines.
- DDDD. Top span and ladder.
- EE. Lower lifts.
- FF. Topsail clew lines.
- GGG. Topsail-yard rest and span for hanging it (when topmast is housed).

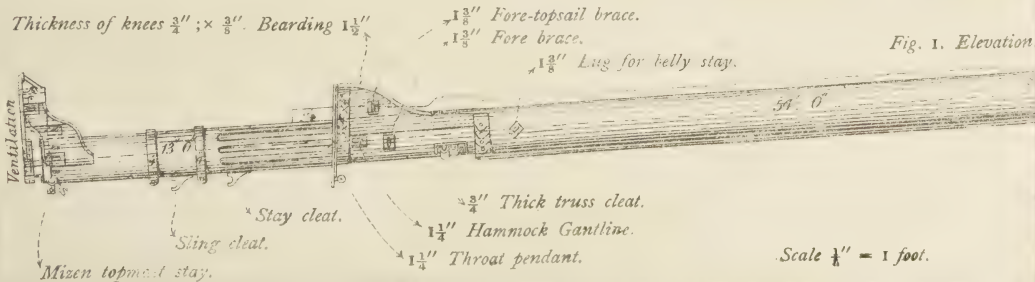


Diagram 2.
PROPOSED PLAN OF TOP AND CROSSTREES FOR TELESCOPIC MAST.

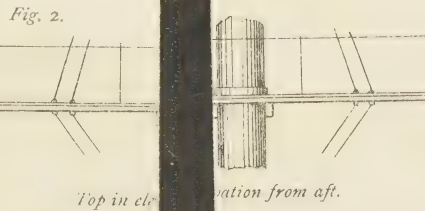
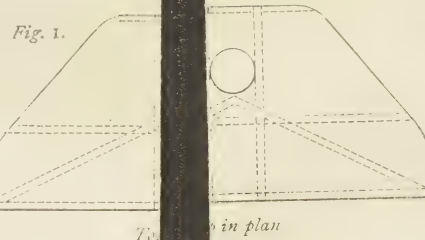
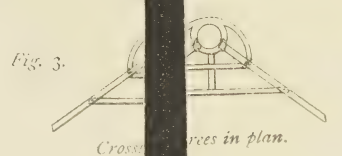
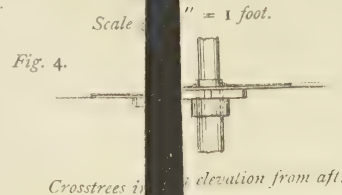
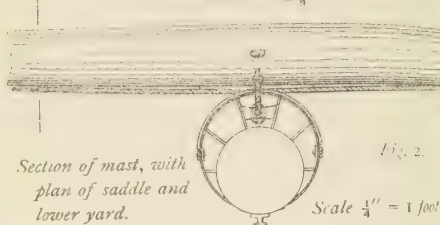
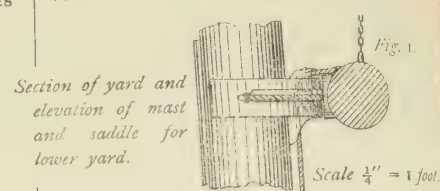


Diagram 3.
PROPOSED PLAN OF TRUSS FOR LOWER YARD.



SHOWING THE MAST FROM FORWARD. THE TOPMAST HOUSED. TOPSAIL-YARD IN POSITION READY FOR BRACING UP.

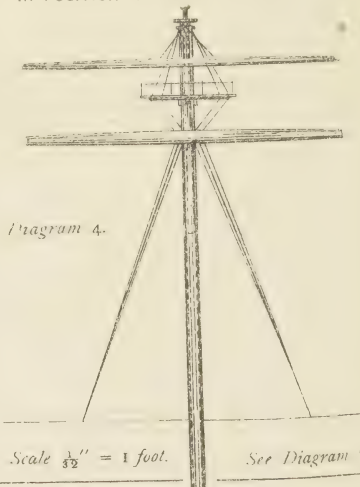


Fig. 1. Elevation

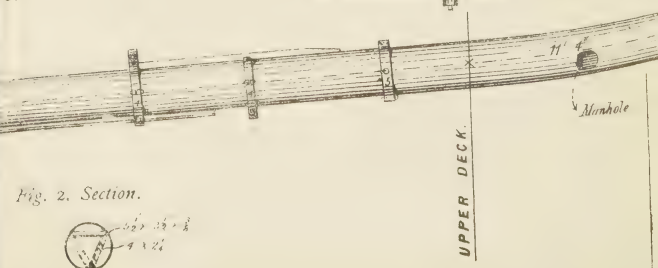
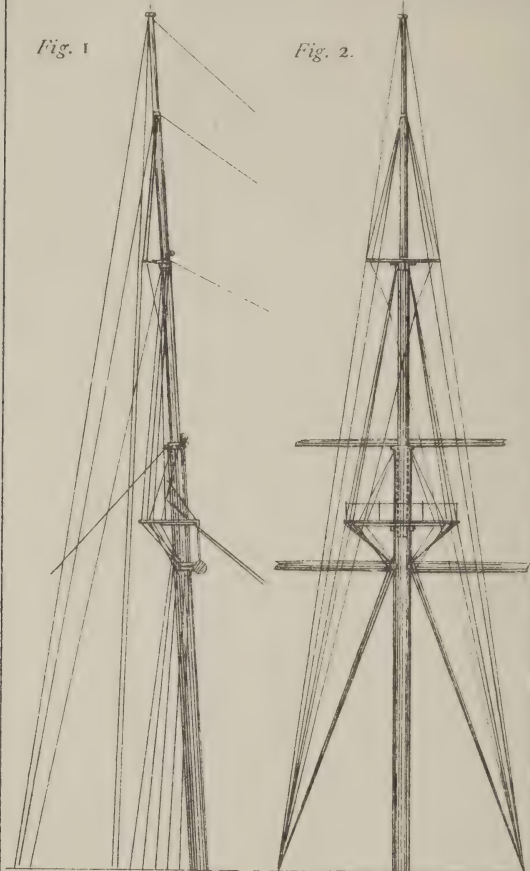


Diagram 1.
PROPOSED PLAN OF TELESCOPIC MAST FOR LOWER YARD.

Fig. 1

Fig. 2.



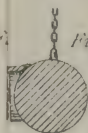
MAST COMPLETE.

AS SEEN FROM ABEAM.

AS SEEN FROM ASTERN.

Scale $\frac{1}{32}$ of an inch = 1 foot.

Fig. 1.



Scale $\frac{1}{4}$ " = 1 foot.

Fig. 2.

Scale $\frac{1}{4}$ " = 1 foot.

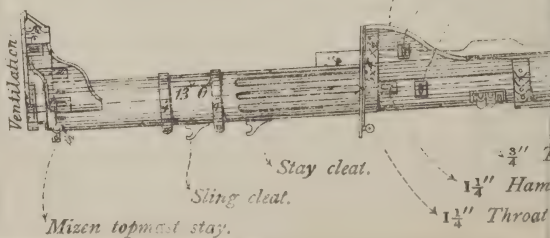
FORWARD.
PSAIL-YARD
RACING UP.



R

Diagram 1.

Thickness of knees $\frac{3}{4}$ " ; $\times \frac{3}{8}$ " Bearding $1\frac{1}{2}$ "



$1\frac{3}{4}$ " Fo
 $1\frac{3}{8}$ " Fo

11' 4"

Manhole

$\frac{3}{4}$ "

$1\frac{1}{4}$ " Ham

$1\frac{1}{4}$ " Throat

Improvements in the equipment of our ships have of late years been gradually effected; for instance, steel is now used in the construction of the lower masts; steel wire rigging and lower and top-sail lifts are fitted; gaffs work on traveller guides on the masts, instead of on try-sail masts, and blocks with iron straps inside the wood are substituted for larger and more clumsy wooden blocks. These improvements are all in the right direction, though they were late in coming, and many of them emanated from the Constructor's department more with a view to reducing the weight to be carried, than to the efficiency of the rig for sailing and steaming purposes, attention to which is essentially the business of naval Officers. Further improvements are still necessary in order to render masting thoroughly efficient for spreading a large area of canvas, at the same time being lighter in construction so as to hold less wind, and also to enable the surface of masting (offering resistance) to be reduced at will, as quickly and as effectively as possible. This must be done by a further use of steel, in masts, and their tops and crosstrees, the use of steel wire in all standing rigging, and even in running rigging in such parts as are of the nature of pendants, or are not man-handled or belayed; by reducing the number of the shrouds, and by facilitating the methods of sending down or housing upper masts and yards, and pointing lower and top-sail-yards more nearly into the fore-and-aft line. With this general idea in view, I have endeavoured to work out in detail the manner in which improvements may best be accomplished in these matters with the following results. The main features of the alterations proposed are—(1) that the masts be telescopic, the top-mast, top-gallant-mast, and perhaps the royal-pole, being all in one, constructed of steel, and housing into the lower mast until only the truck shows above the mast-head; (2) that the standing rigging throughout be of flexible steel wire, fitted as is afterwards explained, admitting of a reduction in the number of the shrouds and backstays; (3) that a cap-backstay amidships be fitted to the fore and main lower masts supporting them from abaft, and enabling the two after-shrouds on each side to be dispensed with, and the remainder of the lower rigging (taken to bolts in the lower masts) to be placed somewhat lower down on the mast-head than it is at present; (4) that the lower yard be fitted with a special truss arrangement, so that it may be braced nearer into the fore-and-aft line, when the top-mast is housed, and consequently the top-mast backstays are out of the way of bracing the yards, and that the top-sail-yard be fitted to hang to a span from the lower mast-head when the upper masts are housed.

Diagrams 1 to 4 (Plate XV) are intended to illustrate the proposed plan. The masts and spars here depicted represent the main-mast of a ship such as the "Calypso," of about 2,765 tons. Diagram 5 is an enlarged drawing of the actual plans of that ship's main-mast. Fig. 1 shows the proposed mast with upper mast fidded, and rigging complete. In this drawing the royal-pole is shown as part of the top-mast and top-gallant-mast, all being in one; this might be desirable in a ship depending to a great extent on her sail power, but would probably be dispensed with in larger types of vessels, where flying royals set on poles triced up

abaft all, and secured aloft, might be used instead when required. The lower mast here represented is of about equal strength and weight to that now in course of construction—by Messrs. Edward Finch & Co., of Chepstow, to whom I am indebted for a great deal of useful information—for the main-mast of H.M.S. “Calypso”; both masts are identical in diameter and thickness of material, namely, $\frac{3}{8}$ inch Siemens’ steel plates, and $24\frac{1}{2}$ inches outside diameter; there is an addition of 3 feet in the length of the proposed lower mast, but the whole height of the truck is about the same. The “Calypso’s” mast is stiffened by three tee-bars, $5\frac{1}{2}$ inches \times $3\frac{1}{2}$ inches \times $\frac{3}{8}$ inch, running up the whole length inside, and the mast is further strengthened by cross-bars (as shown in section, Diagram 5, Fig. 2), at short intervals apart. The proposed mast obtains an equal strength by substituting for these stiffeners and crossbars, four (instead of three) bulb tee-bar stiffeners, which admit of a sufficient space into which a top-mast of the same diameter as that of the “Calypso,” namely, 17 inches, may be housed, the top-mast being steadied by the bulbs of the steel bars, and being guided by two angle-bars on the lower part of the top-mast resting against the side-stiffener, as shown in diagram, Diagram 1, Fig. 3, the top-mast pendant, or heel-rope, working inside the lower mast over a sheave, as also shown here. The top-mast, top-gallant-mast, and perhaps royal-pole, might be constructed in one if made of steel, which material—according to Messrs. Finch & Co.’s estimate—would give the same strength for even less weight than wood. Perhaps this would not be the case if the mast was of small diameter, as with hollow tubes of the same weight per foot (or area of section) the greater the diameter the greater the strength to resist bending strains, limited only by the plates being too thin to support local strains. But we may fairly consider that with a reduced weight of crosstree, and the absence of a top-mast cap, the masts above the lower mast would not exceed the weight they are at present. The diameter proposed is quite sufficient to admit of the top-mast being made of wood, and there is no particular reason why it should not be so constructed with the top-gallant-mast in one spar. The objection to a steel top-mast is the possibility of its being crippled unless carefully handled, and the awkwardness of dealing with it if it is damaged. Against this we have greater strength, and the fact that the part where most of the strain will come when the ship is rolling, namely, that part which emerges from the lower mast-head, is greatly supported by good fitting, no tube being able to bend where it cannot bulge at the sides; so that, after all, the liability to crippling is not very great. A spare mast should be carried, and, if necessary to shift the mast, it must be hoisted out above all, using for the purpose a good spar secured to the lower mast-head and standing well above it. In housing the mast and sending it up again, it is proposed to take the breast backstay on each side to *one drum* (probably amidships on the main-deck), fitted with a break and winch, so that it can be hove in or veered at pleasure; and so by keeping equal strain on the backstays—greater or less according to the rolling of the ship—the mast can be moved up or down, well supported throughout the evolution.

The top, crosstrees, and tressletrees, as shown in Diagram 2, Figs. 1 and 2, are constructed as lightly as possible, of box or tee-bar steel boarded over, or fitted with gratings. The top is similar in plan to ordinary tops; it is supported by light steel wire spans above and below, so as to be independent of the support usually supplied by stout wood crosstrees and the futtock shrouds. The top-mast crosstrees, also of steel, form a small stand with two arms stretching out, one on each quarter, as outriggers for the rigging; a bar joining the two giving additional support, and more room for the men to work. On the underneath side there is a box taking the place of the tressletree, and serving as a rest for the crosstrees when lowered on to the lower mast-head, the top-mast being housed; in this box the top-sail tye sheaves would be fitted to take the place of hanging blocks; the rigging and backstays would be secured to a strong band round the upper part immediately under the crosstrees; the outriggers could be fitted to work on swivels, so as to hang down abaft all when the mast is housed, being hung by light steel pendants from the top-gallant funnel.

The yards proposed would in all cases be similar to those at present in use, made of wood (there being no particular advantage in constructing them of steel); the lower yard, as shown in Diagram 3, is fitted with a plan of truss which I believe will prove very suitable for all lower yards in place of the clumsy chain trusses so universally condemned in the navy, and the patent trusses of the merchant service. It consists of two standing steel wire "rolling pendants," secured to bolts on the side of the mast, taken round the fore part (of the mast) and set up to bolts on the opposite quarters of the yard; these pendants prevent any athwartship movement without in the least impeding the bracing up of the yard, in doing which one pendant winds round the fore part of the saddle, and the other unwinds: they are made to work in a groove so as not to slip off: the "saddle" is a broad steel eccentric ring (standing out from the fore part of the mast and well supported from it by stays), against which the lower yard rests under ordinary circumstances. The yard is kept in position against the saddle by a centre "truss pendant," secured to a bolt on the upper part of the after side of the yard in its centre; the pendant passes through a nine-pin block (which has horizontal turning action), and down the fore part of the mast, being worked by a small purchase: this pendant will have to be eased slightly when the yard is braced forward, and set taut when the brace is belayed.

As regards the rigging, Diagram 1 shows the mast as rigged complete, Fig. 1 a view from a beam (the port rigging being omitted to prevent confusion), and Fig. 2 from abaft. It is proposed that all standing rigging should be of flexible steel wire rope, the strength of which is shown in Table V. A 4-inch cap backstay is the only real innovation; it is intended to support the mast directly from aft, and to take the fore-and-aft strain, which would otherwise be carried by the two after shrouds on each side, which are here dispensed with, the remaining side supports consisting of five $3\frac{1}{2}$ -inch shrouds instead of seven 3-inch as in the "Canada"; the rigging is closer together (being thus less in the way of masking guns) and lower down on the mast-head, so as to allow

the lower yard to brace well forward. The cap backstay being in the way of an ordinary gaff, a monkey-gaff would have to be substituted, setting a good storm sail, and being down on deck, instead of holding wind when the sail is not set. The top-mast rigging differs from that at present fitted, as it is intended to be set up on deck (or between decks); it passes over the top-rim (where it would be clamped), using the top as an outrigger, and is brought through the eccentric ring forming the saddle of the lower yard, over rollers down as much abaft the mast as possible, to drums or some appliance for setting it up; there are three $2\frac{1}{2}$ -inch shrouds a side, instead of four $2\frac{1}{4}$ -inch (as in the "Canada"); the backstays are, as usual, one after and one breast backstay each side of $2\frac{1}{2}$ inches (these would be out of the way of gunfire when the top-mast was housed); the breast backstays would be fitted to work on a drum (as already explained), in order to steady the top-mast while in the act of being lowered or hoisted. The upper rigging is somewhat similar to that usually fitted, only very much smaller than hemp rope, and the number slightly reduced; top-gallant, $1\frac{1}{2}$ -inch steel, two backstays and one shroud; royal, two 1-inch backstays; stays for all masts in number and strength as at present. The top-mast pendant, or heel rope, two parts of 4-inch steel rope, rove in the usual manner through the heel of the top-mast, but working inside the lower mast, would be taken down to the main-deck, and there brought to a capstan or winch (probably worked by steam); the top-mast would be fidded above the top. All parts of the running rigging—such as lifts, braces, sheets, clew-lines, reef-tackles, ties, yard-ropes, &c.—which do not reach the deck, would be of flexible steel wire, of the same strength as hemp, tailed with hemp rope for working, all the wire being rove through small iron-bound blocks, thus saving a great deal of the space, or surface, which at present offers resistance to the wind.

There are two natures of flexible steel wire rope now used in the navy, that known as "Bullivant's," where the wires in the strands are laid up the opposite way to the strands themselves (like ordinary hemp rope), and "Lang's," where the lay of the wires is in the same direction as the lay of the strands; both are of about equal strength, and will work over a sheave as easily as hemp rope of similar strength. Lang's rope is less liable to kink, and for this reason it is preferred for ropes that have to be worked. Table V gives the strength of flexible steel wire rope, and compares the smaller kinds with hemp rope of same breaking test.

TABLE V.—*Breaking Test of Flexible Steel Wire Rope.*

Size of steel rope.	Breaking test.	Remarks.	Corresponding size of hemp rope.	Size of steel rope.	Breaking test.	Remarks.	Corresponding size of hemp rope.	Size of steel rope.	Breaking test.	Remarks.
inches.	tons.	broke at	inches.	inches.	tons.	broke at	inches.	inches.	tons.	
$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{2}$ ton.	1	3	17	20 tons.	8	$6\frac{1}{2}$	98	
1	$1\frac{3}{4}$	$2\frac{1}{4}$ tons.	$2\frac{1}{2}$	$3\frac{1}{4}$	20	—	9	7	113	
$1\frac{1}{4}$	$2\frac{7}{8}$	4 "	3	$3\frac{1}{2}$	24	27 "	10	$7\frac{1}{2}$	130	
$1\frac{1}{2}$	4	—	4	4	31	—	11	8	148	
$1\frac{3}{4}$	$5\frac{1}{2}$	—	$4\frac{1}{2}$	$4\frac{1}{2}$	39	—	12	9	180	
2	7	—	5	5	59	75 "	—	10	220	
$2\frac{1}{4}$	9	19 tons.	6	$5\frac{1}{2}$	71	—	—	11	270	
$2\frac{1}{2}$	$11\frac{3}{4}$	21 "	7	6	84	—	—	12	320	

Preparing a ship—fitted with telescopic masts as proposed—for action, or a steam chase to windward, the upper yards would be sent down, the parrel of the top-sail-yards cast off, and the yards lowered before all, and hung to the steel wire span from the mast-head; the top-mast would then be unfiddled and lowered into the lower mast, until almost out of sight, the crosstrees resting on the mast-head, and the top-gallant funnel above it again; the crosstree outriggers would be doubled down abaft out of the way, all top-mast and upper rigging and backstays being unsnatched from the top and crosstrees taken down abaft the lower mast, and stopped in, so as to offer no additional resistance; the lower and top-sail yards would then be braced nearly fore-and-aft. Sending the masts up again the operation would be reversed. Under favourable circumstances a well-trained crew should complete either evolution in less than fifteen minutes, care being taken to stay the masts before sending the yards across, a comparatively easy matter, if the top-mast rigging is taken to drums worked by a winch.

A great many of the suggested alterations might be carried out in ships as at present masted; for instance, the further introduction of steel wire in standing rigging, the use of steel wire in running rigging, the proposed truss arrangement (so long as it was not intended to house a top-mast at sea), the cap backstay, &c.—all such improvements would tend in the right direction towards making spars suitable for vessels requiring steam as well as sail power.

I do not unreservedly advocate telescopic masting; the idea is an old one, though it has not yet been tried, principally because the materials for its construction and working were unsuitable, but now that steel, and steel wire, can be used for these purposes, that difficulty is overcome. The advantages claimed for telescopic masts are, that it is the only feasible plan of housing a top-mast at sea; that the top-mast and top-gallant-mast once housed are out of the way, instead of lumbering the decks—so housed they might possibly prevent the lower mast from falling if severely wounded in action; and, lastly, the top-mast being housed, and consequently its backstays out of the way, the lower yard can be braced nearly fore-and-aft, and the courses can be set with advantage whenever they will stand. I am sorry that I have not been able to obtain a model from which to explain the working more clearly, but at the last I found myself too pushed for time. There is a model in the Greenwich Museum of a plan for a telescopic mast submitted by the Officers of the Portsmouth Dockyard in 1864; but the lower mast is very large, and the top-mast and top-gallant-mast (in one) is very small, both matters which can be improved by the use of better material.

In conclusion, I trust that I have not altogether failed in attaining the object I had in view in preparing this paper, namely, of winning naval Officers back to a sounder faith in sail power. Perhaps I have not satisfied some of those gentlemen who so kindly supplied me with information on the subject of masting the steamships of the Mercantile Marine, but as a matter of fact I fully concur in the general principles on which those steamers are masted; no merchant vessel is required for cruising purposes, so it is unreasonable to suppose that their owners

will put cruising masts into steam vessels. With ships-of-war it is different; our principal ironclads, which for the safety of our country should never be sent out of European waters, and those armoured vessels intended only for the protection of the Colonial ports at which they are stationed, may well be mastless; but all other ships required for ocean cruising should be well and effectively provided with sail power as an auxiliary to their steam. I am most firmly convinced that any departure from this policy would, in case of a long and severe war, prove most disastrous. I have therefore endeavoured to show that, by judicious modification, masting may be still rendered of very great value, and that sail power should not be considered a dead letter.

Captain P. H. COLOMB, R.N. : My Lord, Ladies, and Gentlemen,—As I have been in some sort challenged by the lecturer in his paper, and as I had the honour to read a paper here on the same subject some time back, I thought it might be convenient to the meeting if I were, so to speak, to open the ball by giving what will be possibly considered somewhat of an opposite view. It is very difficult indeed to discuss a paper of this nature, which, besides dealing with such very important subjects, is such a strong paper. There is no question that the lecturer has taken up a very strong position, and that he is not very eligible to attack. It would be impossible to do it at all were it not for the admirable system which the Institution has adopted of printing the paper beforehand and circulating it, so that we may have the opportunity of thinking over the matter which the lecturer is about to bring forward. I shall be glad to define my position with regard to this question, so that there may be no mistake. I believe that wind-force every day pales before the advance of steam; I believe that in considering the fitting of our ships-of-war we must look to fighting power first of all; I believe that full rig for any steamer burns more and not less coal, besides greatly encumbering her locomotive powers; but I favour any rig which turns out to be a true auxiliary, which does not interfere in any way with the ship's fighting power, which only assists locomotion and economizes coal. I do not believe in a navy arranged to develop a particular class of men. I believe that the British seaman has altered in my time very greatly; I believe he will alter in the time of our successors much more; but I believe he will be still the British seaman, although of a totally different kind—that is to say, that he will be superior, when it comes to fighting, to the seaman of any other nation. Captain Noel says that the wind is “a useful and a powerful element of propulsion.” I say, “useful,” certainly; “powerful,” no; for the simple reason that in ordinary service you always have as much wind against you as you have in your favour. He goes on to admit that “improvements in the system of masting are urgently needed.” When I came to that passage I bethought me of Balak, the son of Zippor, and I considered that whereas the lecturer had been sent to curse me, he had altogether blessed me; for after all, the whole of my contention heretofore has been for this improvement in the rig which the lecturer tells us is “so urgently needed.” He goes on to say that “a long passage at great speed is an exceedingly rare event.” Quite so—in peace time—although my experience does not go quite so far. I am not going to take upon myself, and I suspect very few naval Officers would, and the lecturer, when he comes to take a cool view of it, will not be able to lay it down, that in war time long distances at great speed must not be undertaken by our ships. But our gallant Chairman himself possibly has in his recollection an incident which happened in the Mediterranean, where certainly the passages are not long, but where an urgent necessity required that a ship should proceed at her full speed 600 miles, and it so happened that the only ship which was available, although the whole Mediterranean fleet were with her at Malta, and under similar conditions to herself, was a mastless ironclad. I think that the resistance of rigging in proceeding under steam is very much under-estimated. In my paper I took it at

5 per cent. ; I suppose that the coal cost 5 per cent. by the resistance of the rigging and the spars. I believe it to be considerably more. Of course experiments are necessary. We have not got them ; I wish we had ; but I believe the friction of ropes, and the vacuum formed behind each of them increasing the pressure on the fore side, are elements which make their retarding power very much greater than is generally understood. We should all be struck with this fact, that in the Mediterranean, during the Dulcigno business, where the masted ships were lying in smooth water, land-locked in a very heavy gale with terrific squalls, most of the ships present had their lower yards and topmasts struck : some of them had three anchors down, and some dragged their anchors. The single mastless ironclad—the “Thunderer”—was lying the whole time at single anchor with her buoy well out on the starboard beam, and she never even approached the tautening of her cable. I am quite sure Lord Alcester will recollect that ; and although it was not entirely due to the absence of masts and rigging, I cannot help putting some of it down to that absence, and I am borne out in that by what happened to the “Inflexible” not very long ago, where, being masted and having the same anchors—the Martin anchors—as the “Thunderer,” she, not in anything like the same weather, dragged those anchors. That is one of the things which make me think that the resistance is under-estimated. The lecturer gives us to understand that the single mast for machine-gun firing is an absolute necessity. I am a little doubtful about that. Of course we are so using it ; I presume we are bound to use it now. We are furnishing the masts of our ironclads with considerable structures for the purpose of carrying machine-guns. What I am afraid of is that, as in the “Huascar,” those structures may become, more or less, slaughter-houses, inasmuch as they will certainly draw the fire of the machine-guns upon them, offering such an extraordinary mark, and the men being so crowded together that what misses one will hit another. The lecturer goes on to speak of “cruizers” and “cruizing,” and I am afraid he and I, and all of us, more or less, are misled by the old meaning of the word “cruizer.” A cruizer in old times was always in motion, but the orders she got were seldom such as to dictate motion. She was generally to maintain a position on a given spot, and it has always struck me that this “cruizing” in war time would now simply be going and lying on a particular spot, and remaining on that spot a given time, as closely as possible ; and I venture to think that taking a fully-masted ship and an unmasted ship of the same coal capacity, the unmasted ship would probably have more coal in her bunkers after a given time of such “cruizing” than the fully-masted ship, because the one would be blown off her station while the other would not. The lecturer also speaks of “convoys,” and he certainly uses the term “steam-convoy.” But he does not seem to carry in his mind what steam-convoys mean. I cannot avoid thinking that steam-convoys will proceed at some considerable speed, and I feel that most of our ships, being fully rigged, would not be able to keep up that speed which was necessary for the ordinary steam-convoy. We come then to the question of coal endurance. I have taken two ships. I do not mean to say that they offer any argument, but they are simply illustrations to give us matter round which our minds may circulate. I take the “Comus,” which with 440 tons of coal could keep up a speed of $13\frac{1}{2}$ knots for six days, or 1,950 knots ; or a speed of 10 knots for thirteen days, or 3,120 knots. Now I pass to the “Hecla.” She can take a great deal more than this, but suppose she can take in 2,000 tons of coal. She will go 10 knots sixty-nine days, or 16,000 miles ; and if you come to cruizing at low speeds, or using low speeds only, she will go $6\frac{1}{2}$ knots 166 days, that is to say, 26,000 miles, and it looks very much as if the “Hecla” might coal at the beginning of a war and not positively have used the whole of the coal when the war was over ! There is a strong feeling at present as to the collier tender, and the lecturer is very firm as to putting your coal outside the ship rather than inside. I think his argument is identical with what used to be urged before the days of steam line-of-battle ships. We all recollect how strong the feeling was in those days, that we ought to build more paddle-wheel steamers, the object being that they should attend the sailing line-of-battle ships, and should tow them in and out of action ; and it was a considerable time before the service frankly gave itself over to putting the paddle steamers inside the line-of-battle ships instead of outside. I cannot help thinking that condition of things will be also brought about with

reference to the steam collier. The lecturer has laid great stress upon the difficulties of stowage of coal. Now I do not see that there is any such difficulty. You have to make the ships longer. The practical question is to get speed, and to do that you must have length, and small beam in comparison. Doing that, you can always get sufficient coal supply. The lecturer draws a comparison between the case of a sail-masted ship out of coal, and the case of a steamer without masts, possibly without coal also. But supposing the other steamer has coal; what possible hopes can a sailing vessel without coal have of winning any action against a steamer with coal? In Table No. 1, he leaves out the retardation, and also the question of stores and accessories, which must follow masting, and I think, therefore, that table must be somewhat modified in order to be applied in practice. But then I think all the real power of sail can be got with very much less weight. Coming to sailing passages, I do not think it is quite fair to take a special case. As a fact we know that the speed of sailing passages is exceedingly small, except in those cases where ships are built specially for particular runs, and can make use of a fair wind, sometimes one way and then the other. The present steam war-ships, we are told, sometimes make worse passages than the old sailing ships. I am afraid that is the case, but it is because we are allowing the steam and sail to fight a battle in the ship without either of them being permitted to gain the victory. The lecturer has laid it down that the crews ought to be sufficient to work masts and sails. I am not quite prepared to say that they ought not to be sufficient to work the masts and sails; I only say that, by some occult process, that is not now the case—the tendency is the other way. We have in a ship of 9,500 tons, for instance, a complement of 691, and we only have 336 seamen; in another ship of 7,600 tons, with a complement of 576, we have 283 seamen; in another smaller ship of 5,400 tons, with a complement of 452, we have 243 seamen only; in another, essentially a sailing ship, of 4,100 tons, with a complement of 407, we have only 174 seamen; and it gets worse as you go on, because in more modern ships still, of 7,400 tons, with a complement of 436, you only have 188 seamen; so that, in spite of us, the numbers are being reduced, and I cannot see how we are to increase them. One of the difficulties, no doubt, is the difficulty of finding space for them, of which the lecturer speaks so lightly. I wish he were Captain of the Steam Reserve for a little time to correct that view. But, as a matter of fact, the condition of our war-ships is such that whatever else we might want to do, we cannot find the time with an ordinary crew to properly work the masts and sails. I am sure there is no one in the service, at any rate of those who have had the honour, and I may say the pleasure, of serving under the gallant Chairman, who will doubt that he is a man more likely than any other to make full use of every appliance which is under his control in that way, and he must know that in the Mediterranean squadron it was, as a rule, a difficulty to get that amount of raining and drill aloft which was generally considered desirable. Either the wind was ahead, or the passage had to be made at a certain speed and we could not wait. There was one occasion certainly when we got a bit of fair wind, and the masted ships turned the unhappy mastless ship away about her business, but in the end she came in with a great deal more fuel than those who had started so gaily with a fair wind. The lecturer, speaking of seamanship, tells us that in cruisers the smallest possible working of sails and spars will be requisite for preparing for action or chase. What I am afraid of is, with the existing rig this "preparing for action or chase" would mean a general pitching overboard of the sails, because I am assured that any "chase" will go straight in the wind's eye. They will certainly never take the other line. Then we have a subject adverted to by the lecturer which we cannot yet get rid of, namely, that sail work is a necessity in the training of Officers and men as to discipline. I continually think to myself, "Is this true?" I cannot make up my mind about it; but whenever I see, as I saw the other day, a parade of eighteen or twenty blue-jackets, hard at work with batteries of electric cables and Whitehead torpedoes and galvanometers, and a variety of appliances which were utterly beyond me, requiring the most delicate handling and careful watching, any mistake meaning the destruction of the ship, supposing the torpedoes had been filled, I could not help thinking, Are these men the better for having been royal yardsmen?—supposing they ever had been. I do not dogmatize,

but I cannot help asking myself the question. Of course it is impossible for us to look at this change which is going on in the service with easy minds. We cannot help thinking, "Dear me! the days of our powers, and our display before the world as a navy, are disappearing!" As the lecturer says, "steam is equalizing things." I do not think myself that it is; I believe that we are going to take the lead in steam just as before in sail; but the point of the matter is this, that these changes will take place unless we are duly prepared to hang those inventors who bring forward new weapons which are not asked for! If we had hung Dr. Gatling, and Mr. Whitehead, and Mr. Nordenfelt, we should not be in these troubles now, and until we are prepared to take that sort of action, I am afraid the thing will change in spite of ourselves. I ought to be much more side by side with the lecturer when I come to the second part of his paper, because he is proposing a modification of the rig, and that is my point. I want to see the rig so altered as to give a real efficient help to the ship without in the slightest degree encumbering her, and although I must say I like a great many parts of his proposals, I do not like them as a whole. The lecturer does not seem to have been quite clear upon the point, that were you to rig a ship in this way the only sail which is really of use to the ship will be the double reef topsails and the reef topfore-sail—that is to say, giving the proportion of area which he gives to the plain sail. I want to give a greater area of strong sail and to reduce the area of light sail as much as possible. Then all these appliances for easing the working of the sails tell against that process which you want to keep for the training of your men. If you make the process very easy the men get none of the training which they are now getting, for essentially that training is the overcoming of the difficulties which at present exist. The lecturer says we do not need these alterations and appliances in our own navy. Certainly not, because if we did we should lose the drill and training which we are told we want. When I read my paper, I was pretty strong upon the question of the mastless ships, but I had not then commanded a mastless ship. My impression is, that if any person had gone through my experience, first commanded a masted ironclad, and then a mastless ironclad, his instincts in favour of the mastless ship would have been so immensely aroused, that it would be almost impossible for him to argue fairly on the question, and I grant that very possibly my experience prevents me from arguing quite fairly on the question; but still I cannot help thinking that what we want to do in our war-ships is to become utterly independent of the elements. They are not to be coaxed: they are to be mastered. You must draw their teeth and pare their claws, and when you are thoroughly masters of them, then you may play with them—if you like!

Admiral Boys: My Lord and Gentlemen,—If it had been a custom of this Institution to second any resolution, or to second a paper, in spite of what my friend Captain Colomb has said, I should have been very happy to have seconded Captain Noel's paper. My opinion has always been that sail power in certain descriptions of war-vessels is indispensable. He has very clearly divided his ships into classes and groups. I will touch shortly upon each class as numbered. No. 1, "Coast service ironclads," I agree with Captain Noel. No. 2, "Special cruisers, or despatch vessels," I do not altogether agree with, for the same reason that Captain Colomb has given. I draw a conclusion directly contrary to him with regard to having no masts at all. These are cruisers of the "Iris" type, and their special duty is chasing; Captain Colomb implies that chasing is always to be in the wind's eye. I differ from that because it must depend upon where you discover your chase. If you discover her to leeward, or in the vicinity of land, you will of course not let her cross you to get to windward of you, and the addition of sail power may in that case enable you to catch her, when without it you would lose her. I will instance what happened in the case of the old "Warrior." When first commissioned her full steaming power was from 13 to 14 knots, but she actually, for some consecutive hours, running free with a strong breeze with all plain sail set, made $17\frac{1}{2}$ knots, and if that had been in chase, those additional 3 or 4 knots would have been the means of attaining the very object required. Class 3, "Swift vidette vessels."—Yes. With regard to ironclads of the "Téméraire" class, Class 4, I quite agree with what Captain Noel says. It happened to be my duty

to be sent out in the "Devastation" on her first cruise to the Mediterranean. The "Hercules" was to accompany us. We started one evening from Portsmouth to go to Plymouth, with a nice easterly breeze steaming easily 8 or 9 knots. The next morning the "Hercules" made a signal that her cylinder was cracked and she could not steam any longer. She made sail, and kept her station alongside of us all the way to Plymouth. Now if she had not had those masts she would have been a helpless log, and could not have moved without assistance: that is one instance in which the sails of the ocean service ironclads actually did come into play. On the subject of machine gun fire from one mast it is generally accepted that machine-gun fire must be kept under by machine-gun fire, as Captain Colomb says, and I think the machine-gun in the top has a great advantage over the machine-gun on the deck. There is another purpose, which has not been mentioned, for which the one mast becomes a necessity, viz., to hoist in and out heavy weights, especially torpedo boats, which amount to 12 or 13 tons. Class 5.—I quite concur. Class 6.—Yes. Captain Noel says, in regard to Class 7, that small coasting cruisers of 800 to 1,500 tons should be amply rigged. In that opinion I do not agree. I think these vessels, being only coasting cruisers, and never far from a port, will always be able to renew their coals. They are not intended to make long passages. The lecturer goes on to "arguments for and against sail power," and he adduces the system and practice of various lines of ocean steamers. I do not think any satisfactory conclusion can be drawn from the action of these mercantile steamers with regard to sail power, for the reason that they start from their port, and go on for hours and days, and perhaps weeks, without any alteration in speed. Their engines are constructed for this purpose, whereas most men know that in a man-of-war, especially in fleet manœuvres, with the exception of the flag-ship, the alteration in the amount of revolutions and speed is something interminable, and for that reason I do not think we can make a comparison between what is done in men-of-war and merchant vessels. With regard to the resistance of the wind to masted ships, Captain Noel's figures come to this, that in the "Greyhound," in a calm, going 15 knots, one man power exerted more by the engines would compensate for the resistance of the air. I do not think that is very material, and with regard to the remark about the resistance offered by masts going head to the wind, and the assistance of sail when we are making a fair wind of it, it comes to this, that when we are going head to the wind, we reduce our mast to almost nothing, but when we are making use of the wind we expand the power of the masts a hundredfold, or more, by setting sail wherever it will draw. With regard to steaming and sailing qualities combined, my impression of Mr. Froude's experiment is that it was only at low speed that the proportion of breadth to length did not interfere much with the speed. At high speed I believe it really does, and I do not think that Mr. Froude's experiment ever warranted the same conclusion as to very high speed. Certainly our Mercantile Marine Constructors do not think so, for they have increased the length of their ships to ten or twelve times their width, and thus obtain their great speed. With regard to the "numbers, efficiency, and discipline of crews," of late years the tendency has been to reduce crews to a minimum. I believe it has principally been done at the suggestion of the Constructor's department, the great object being to save weight, as every additional man increases the weight to be carried, not only in himself but in the bag, hammock, &c., required for him. I think crews have been reduced a great deal too much. We can never send our ships cruising all over the world to destroy an enemy's ships, like the "Alabama" did, because we should have to send prizes to a Prize Court for adjudication, and to put prize crews into them for the purpose, and where the crews are so very small we could not possibly do it. I think we *must* increase our crews. I recollect some years ago I was appointed to the command of the "Pelorus," a ship once commanded by our noble Chairman; we were starting for China, and were ordered to take out thirty supernumeraries. I did not want to be troubled with them, with their hammocks and baggage; however, they were sent. We stowed them away somewhere or other, and when they had shaken down, we were very glad to have them. I think there is too much complaint made of not having room to put the men in our ships. We must increase the crews and let them find room, and

depend upon it they will do so. With regard to Captain Noel's proposed rig and bracing up yards, we have learnt one lesson, that we must be cautious how we allow the yards to brace too readily fore and aft. One of the supposed causes of the upset of the "Captain" was the topsail yards flying fore and aft in the squall, on account of the tripod masts, and they had not power to brace the yards in again to get the sail off. That was adduced as one cause—bracing up too sharp. In my opinion, as long as we have a navy that depends upon coal as the means of propulsion, it will be a monstrous waste not to make use of that universal and costless power, the wind, and we must not forget the old ditty that "when the wind blows then the ship goes."

Captain HARRIS, R.N.: My Lord, Ladies, and Gentlemen,—Long ago, when I read Captain Colomb's very valuable paper, in 1878 I think, on *Sails v. Steam*, I fancied he had gone rather too far in condemning sails, but now I agree with every word of it; indeed I go so far as to think that his paper of 1878 is appropriate to the present time, and that Captain Noel's paper would be more appropriate to that period. I believe that masts and sails, in most cases, are only an encumbrance, and waste of time and power. Still I cannot help regretting them; and I confess to enjoying, as much as anybody, the glorious feeling of bounding over the waves, under the influence of sail power alone; still the common-sense view must be taken, and delightful as those feelings are we must put them on one side. Steam is gradually and relentlessly driving everything before it, and masts and sails will have to go too. However, I think we all ought to be exceedingly thankful to Captain Noel for putting the matter in such a very good light. In this way we are able to judge very fairly of the respective merits of steam and sail; we have had the matter most ably advocated on both sides. I am glad to find that Captain Noel seems to be quite of one mind with Captain Colomb as to the uselessness of masts and sails for actually fighting armoured vessels; in point of fact, when he treats of ironclads of the "Téméraire" class, he there also seems a little doubtful whether masts and sails are a matter of great moment; but when he comes to actual cruisers, then he makes a great point of it. Now whenever I see a cruiser heavily masted and rigged, the story at once occurs to me of the old woman who was selling apples on a common during a very windy day; it was in the time when so much crinoline was worn; a small boy came up to her stall and made off with an apple without paying; she ran after him; with a strong breeze at her back she was quickly overhauling him, until a sailor, standing by, seeing with his nautical eye at a glance how matters stood, shouted, "*Try her on a wind, my boy.*" The moment the old lady had the wind against her she was nowhere in the chase, and the boy easily escaped with his apple. So will it be with the cruiser of the present day, if encumbered with heavy masts and sails. Captain Noel says that "his object in writing this paper was to win back some of the wavering to a sounder faith in sail power." But I should rather put it thus: that he is trying to win them back to an unsound faith in sail power. Captain Noel refers to the wonderful and almost historical passage of the "Vindictive." Now I think it is somewhat unfair to make so much of such an exceptional case: without putting against it all the slow passages on record, including such facts as that a sailing line-of-battle ship has been six weeks making the passage from Gibraltar to England. There is no doubt, however, that having masts and sails, and the power of being able to exercise men aloft, does certainly seem to make the seaman more active and cheerful; but I think what we gain in this exercise we lose in others which are of more importance to the efficiency of a vessel, especially when we reflect on the heavy shorthanded work that has to be done now in our men-of-war. There is one other thing we ought to take into our consideration in dealing with the question of masts and yards, and that is the number of men who have been killed or invalidated out of the service through accidents happening aloft, mostly at drill. Captain Noel has, apparently, in theory, produced a very clever plan for reducing masts and yards to a minimum in a very short time: this is, to my mind, a convincing proof that he is alive to the disadvantages inherent to heavy masting. Here I am quite of his opinion; and certainly, if we are going to retain heavy masts and sails for cruisers, it will be well to adopt his plans: but personally I think it far wiser to let masts and sails gradually die out than go to the expense of adopting any new system.

Captain CURTIS, R.N.: I may state, with regard to our old line-of-battle ships, that I was in one, the "Queen," that went out to Malta in ten days and a half. In 1846, the "Inflexible" paddle steamer, which was started to the Cape with half a regiment of soldiers on board, and 80 tons of coal short, by courting the wind, made the passage to the Cape in fifty days without replenishing coal. The true policy is to court the wind and not to ignore it, for we can never conquer it.¹ It is by ignoring the wind that many merchant vessels are lost: that is, we are told, the sea is impelled in a cycloidal curve form, and by keeping the maintop sail, close reefed in a gale, on the ship,—when youngsters we were told never to take the main topsail off the ship, but to heel her over, "*and give her a weather side*"—by so doing we prevented the sea from overwhelming the ship. What I maintain is that by not having sail power the ships are very often overwhelmed by the sea. In doing away with the masts you do not actually gain the amount of weight which the masts and sails weigh, inasmuch as you have not the storage room in the ship. For instance, a mast does not take up any room below, and you cannot find space for the amount of coal that the masts, &c., would weigh. It is perfectly true that in the Baltic, in the Channel, and in the Mediterranean, it is a good practice to have mastless ships; but we are told that in the Pacific, the East Indies, and so forth, where we have sea-going cruisers, it is absolutely necessary that you should have coaling stations, for there is no coal port that we can go to between Vancouver and the Falkland Islands, on the Pacific Coast, that we can call our own. We put in at Valparaiso, but if we were at war with a Power friendly to Chili, do you think they would fill us up with coal, coal being a munition of war? I think it is out of the question. I perfectly agree with the lecturer and also with Admiral Boys; I do not think we have come to that enlightened period at which we can ignore the winds, but I think we must in a certain class of vessels maintain sail power, so as to enable us to keep the command of the sea; sail power is a necessity as a means of safety in a gale, and in case of mishap to the machinery.

Captain NOEL: My Lord, Ladies, and Gentlemen,—I think you have almost heard enough of my voice to-day, but I would nevertheless like to answer a few of Captain Colomb's remarks. First, as regards long passages. I think we must have certain vessels of the "Iris" class (carrying plenty of coal) to make the long passages, or passages with great speed; but I doubt very much whether the ordinary ship-of-war of our service would ever in war time be required to make long passages. With regard to the resistance of ropes, in my paper I have fully acknowledged the importance of this question, and have endeavoured as much as possible to get rid of the resistance due to the ropes. There is no doubt we have a very vague idea of what the cruising of the future will be, but "cruising" is a term which includes a great deal. It does not mean only remaining at a certain position. It means cruising from one port to another, and so on. It is in these short passages that we expend our coal, and my object in advocating masting is that in all those petty little movements from one port to another we should economize coal. Captain Colomb compares the "Hecla" with the cruiser. Now I consider, with all due deference to him, that it is an absurd comparison.

Captain COLOMB: I said as an illustration.

Captain NOEL: I meant that there is no comparison whatever between the two. There is no doubt that the "Hecla" can go round the world and not expend all her coal, but what is the "Hecla"? Simply a merchant vessel. She is not a fighting vessel; she has no great speed; she could not get away from the least of our cruisers; she would be taken by the first craft that could fire four guns at her. What I contend throughout is that if you are going to have the cruising vessels that Captain Colomb and Captain Harris are so anxious to introduce, you must have them immense. I think the other day Captain Jackson talked about cruisers of 10,000 tons, and I believe he is perfectly correct, if masts are done away with; you cannot otherwise carry the coal. Mr. Barnaby says, "I must have

¹ See Captain Washington's Report, 28th July, 1849, on the Loss of Life on the East Coast of Scotland, 19th August, 1848—"No boat ever known to be lost by shipping a weather sea; boats lost by not carrying sufficient sail, &c."

tonnage ; I can do nothing without tonnage ; I cannot get speed, and I cannot get coal-carrying power," and therefore it follows if you do away with your masts you must be prepared to have cruisers of 10,000 tons. Masts are a means of economizing fuel, and in that way you enable the country to have cruisers of moderate dimensions. The "Vindictive" was not a special ship. She was an old 60-gun liner, cut down and made into a 50-gun frigate, and about ten years after being cut down she made this passage—a most extraordinary passage, no doubt ; but she was not built as a special ship. Still I do not know why Captain Colomb should attempt to give us to understand that it was an extraordinary feat which only happens once in a generation. Against this impression we will just consider the clipper ships. The clipper ships were, we may say, almost as regular as the mails. Taking the tea-clippers from Foochow to the Downs in 1866, three made the passage in ninety-nine days, and two of them raced up the Channel. In 1868 the "Ariel" made the passage in ninety-seven days, and in 1869 the "Sir Launcelot" made the passage in ninety from Foochow to the Downs. What I say is, that if we thoroughly understand the sailing passage, we ought to be able to make it with almost the regularity of a steamer. Now we are throwing sail power out of our calculations, and the consequence is we are forgetting how to use it. Now about reducing the crews. I must say this is a most serious consideration. I fully concur in all that Admiral Boys said ; and this consideration alone, to my mind, makes it necessary that we should have masts as a means of employing the men. Captain Colomb has rather contradicted himself, for he tells us that we cannot find time for sail drill, &c., and then the moment afterwards he says, "According to the lecturer's diagrams he is going to make everything so nice and neat that we do not want the time, and should not have employment for the men." I wish to show that between the two we do get the necessary amount of employment for the seamen. When it is requisite to prepare for action, down would come the masting as easily as possible. We still have a gymnasium (as we may call it), which keeps the men employed, and which is conducive to discipline, order, health, and everything else. It is a very curious thing to me that whereas the military are making gymnasiums all over the world, we appear to want to do away with our gymnasiums. No doubt with old appliances it did take up a lot of time, and I daresay that squadrons, when they have many other things to consider, could not get time to work the old plans of masts and yards, but if you have improved appliances, you can keep up your exercise in peace time ; and when there are other duties to do, very little is required in order to reduce the masts or to make sail again. With regard to the area of strong sail, I can see no objection to obtaining a good area of strong sail in the proposed plan. In fact, I am for giving a good area of strong sail. Unlike housing your topmast before all, a telescoped topmast is entirely out of the way of the lower yard, and consequently your course is always ready for setting. I have thought of that difficulty referred to by Admiral Boys as regards bracing the yards up too. No doubt it is a very great danger. But when the topmast rigging and backstays are in place there is no possibility of bracing the yards any further forward than it would be now, and the topmast rigging would prevent the topsail yard going further than it would before. There is one other point, with reference to the question of coal. If you have no working crew on board a vessel, you must do everything with your auxiliary engines ; and in time of war, when our vessels are miles away from the coal stations, you will find that your coal is being used up by its daily consumption for auxiliary engines, and that will be very large, owing to the fact that you have not got a crew to do the work. Captain Colomb gave us some numbers of seamen, and said that you want the seamen to go aloft alone ; but I do not see why ; when making a sailing passage, the Marines and stokers can do the deck work. We do not want the stokers to go aloft so long as we have seamen who have been trained to do the work that is necessary aloft. Gentlemen, I am much obliged to you for your kind attention.

The CHAIRMAN : I am sure we are all very much obliged to Captain Noel for his very interesting lecture, and also to Captain Colomb for what he has said. Perhaps you will allow me to say one or two words bearing on the point. First of all with reference to the relative effect of winds on unmasted vessels, and on masted

vessels in bad weather when at an anchor. No doubt if Officers, commanding ships being in 20 fathoms water, let go their anchors and veer only to 40 fathoms of cable, something is likely to happen if a squall should strike them. Captain Noel, I think, has hit the nail on the head by saying that if you want cruising vessels under coals alone, you must have your ships of 10,000 tons. He has also alluded to the eternal working of your auxiliary engines in order to do the work on the ship, and I am sure no better illustration of that can be found than in the "Inflexible." There is also another point which must be considered. You have not got now, with your 110 rounds of shot and shell, half enough ammunition on board your ships. It is all very well in the Mediterranean, or the Channel, near your own ports, but what do you suppose would be the effects of the next action which takes place in the Pacific? I do not mean when you are close to Esquimaux, where you have got a dépôt, but anywhere else, and that is a most serious consideration. You cannot have room for your coals, and shot and provisions, and therefore you must, in my opinion, trust very largely on distant stations to your sail power. The Italians have the largest vessel on the stocks and afloat, and they are going entirely for very large coal storage and mastless ships—just two trysails. In France, all the larger class of ironclads, like the "Redoutable," are having the yards taken out of them entirely; the lower masts are left, with a very strong battery of machine-guns on the top. In Germany they have not done away with the practice of having full-rigged ironclads; but this year, owing to the short time of their ships being kept in commission, they have decided to send steamers with lower masts alone, and with poles for the topmasts for signalling. I am afraid, by-and-bye, we shall have too much the same sort of thing, as we generally follow other people's notions, and I shall expect to see, before many years are past, all our ironclads in the same way. I shall be sorry to see it, because I think in the Mediterranean and the Channel you are so close to your own ports that at the first outbreak of war you could get rid of all your topmasts and yards instantly. Until then, I am quite convinced, it is of the utmost service to our men in every way to have the means of exercising them aloft. As I said the other day in another place, I am fast going into old fogeyism; but still I maintain the opinion that it is from the top-gallant and the royal yard men, and the men stationed aloft generally, that you get your best men, who afterwards will doubtless be found, under Captain Colomb's direction, filling shell, and employed in various avocations where the nerve that they had acquired at our mastheads will serve them in all other capacities so well. I beg, on your behalf, to return a vote of thanks to the gallant lecturer.

Friday, June 8, 1883.

ADMIRAL SIR FREDK. W. E. NICOLSON, BART., C.B., Vice-Chairman,
in the Chair.

HARBOURS OF REFUGE IN CONNECTION WITH THE SUBJECT OF CONVICT LABOUR.

By Colonel Sir CHARLES H. NUGENT, K.C.B., R.E.

It will perhaps be matter of surprise to some at least here present, why I, who neither am a naval Officer nor have any connection with convict prisons, should have undertaken this subject.

In explanation of my position here I may say that I have undertaken it at the request of the Council of this Institution.

Possibly the Council, the services of a more qualified exponent of this subject failing them, may have considered that long connection with the defences of Great Britain, which led me to a personal examination of nearly every bay in the United Kingdom, and necessitated a careful study of the Reports of the Commissions on Harbours of Refuge, as well as many years' personal experience of the employment of convict labour on large national works, were sufficient qualification for the introduction to you of this subject.

The interest in Harbours of Refuge has been recently revived, partly, perhaps, because Government is about to undertake the completion of Dover Harbour, and partly, perhaps, because it is understood that a Committee which was assembled in 1880-81 to consider the measures necessary for the defence of our principal commercial harbours was, in the course of its investigations, drawn to examine the merits of Folkestone as a position for a Harbour of Refuge on the East coast; and it is wise upon the part of the Council of this Institution, which has done so much to rouse public opinion upon many matters of national importance, to bring this subject before the public at the present time.

This may well be a subject of national interest, for it concerns a large portion of our population; it is not only the seafaring population and the shipowners who are concerned in this subject, but the shipbuilding and the mining and mercantile classes also.

Some idea of the magnitude of the interests involved may be derived from the number of vessels engaged in the commerce of the country and the number of seamen employed in them.

In 1881, 19,307 sailing and steam-vessels, of an aggregate tonnage

of 6,490,953 tons, were engaged in trading at home and abroad; they were manned by 168,098¹ seamen and boys.

In addition, 66,682 boats were occupied in fishing, manned by 124,561 men and boys.

So that the operatives afloat directly interested in, and to be benefited by, the creation of Harbours of Refuge number 317,464, and if the Royal Navy (45,100 seamen and 12,400 marines) be included the number rises to 374,964.

It is probable that at least 120,000 men are employed in the collieries, a great part of the produce of whose labour is sea-borne.

But the pecuniary considerations involved are very large, for instance, the actual value of the vessels afloat may be taken at 63,614,744*l.*, and the merchandize they carried last year was worth 694,155,264*l.*

Of course this latter figure is very fluctuating; it is 3,538,657*l.* less than in the preceding year, 1880, when it was 85,868,792*l.* greater than in 1879.

But fluctuate as it may, the value of the commerce always on the water is so great that neither pains nor money should be spared to insure its safety.

In the matter of Harbours, it is worthy of notice that, while of late years our Government has been supine, the French, with not half our trade,² have been most active. On the shores of the Channel alone, and within a length of 250 miles, viz., between Dunkirk and Cherbourg, they have undertaken works at nine harbours, representing an estimated expenditure of 5,574,000*l.*

Dunkirk	£2,000,000
Calais	748,000
Boulogne.....	680,000
Tréport	144,000
St. Valery	82,000
Dieppe.....	580,000
Fécamp	240,000
Havre	920,000
Honfleur	100,000
Cherbourg	80,000
	<hr/>
	£5,574,000

As preliminary to the consideration of our subject it may be well to state what the conditions are which a Harbour of Refuge should satisfy:—

1. It should be easy of access in all weathers.

¹ This is exclusive of foreign seamen, who numbered 24,805.

² Imports of France..... £163,050,000
Exports „ 123,080,000

£286,130,000

(Exclusive of Colonial trade.)

2. It should have ample and secure anchorage.
3. It should have good holding ground.
4. It should be available for as large a number of vessels as possible.

These are the aqueous and subaqueous considerations, which must have their due weight in the selection of a position for a Harbour of Refuge, but they must be influenced by other, terrestrial, considerations, such as the nature and form of the adjoining ground, and whether these lend themselves to economical construction, also whether they afford facilities for communication with the commercial centres of the district.

The Royal Commissioners on Harbours of Refuge, in their Report in 1859, drew a marked distinction between *Harbours of Refuge*, in which in bad weather, "all vessels," not those only habitually frequenting that part of the coast, "should be able to take shelter for the purpose of avoiding the risks and wear and tear incurred by keeping the sea, and the loss of time occasioned by being driven back;" and *Harbours*, styled by them *Life Harbours*, of which "facility of access and sufficient shelter are the essential requisites," and of which the positions must be governed by local considerations.

It is not my purpose to devote much consideration to these latter, which the Commissioners recommended should be constructed, either out of funds raised locally, or out of part local and part Imperial funds, and should be thereafter maintained by tolls levied on the vessels making use of them.

The object of the Council is that attention should be drawn to *Harbours of Refuge*, designed to offer hospitality to all vessels alike, independent of nationality, and which, being for the general good, should be constructed and maintained, as national undertakings, out of Imperial funds.

If then the Imperial Government undertake the construction of harbours of refuge, the question for its consideration is how it can most economically construct them.

The answer is not far to seek. In the convict prisons it has a large body of men, about 10,000, whom it is compelled to maintain, and for whom, on social even more than on economical grounds, it is compelled to find employment. Fortunately the form of labour most suitable for their employment is precisely that which enters so largely into the construction of some descriptions of harbours of refuge.

I refer to unskilled labour, or to labour so comparatively unskilled that expertness in it can be acquired in a short time, and well within the average duration of penal sentences.

There are other forms of work upon which labour can be applied in large bodies, such as the Dock Extensions at Chatham and Portsmouth, and the massive fortifications at Portland, but these are beside the subject of this paper, and I refer to them here simply because the labour of the convicts upon them has been attended with satisfactory pecuniary results; no doubt, the main portion of these works consisted of unskilled labour, and the nature of the works was such that convicts could be employed in considerable numbers upon them.

When employed in small numbers the labour of convicts will not be remunerative.

In my opinion, not less than 500 convicts can be profitably employed upon any one independent work, though I am aware that it has been proposed to make use of as small a number as 200.

In the "Report of the Directors of Convict Prisons for 1881-82," I find that upon the War Department and the Admiralty works at Portland the proportion of unskilled labourers is about two-thirds of the number of prisoners employed on them; the exact figures are 648. I find also that the average number of male prisoners does not vary very much from year to year; that last year the number was 10,221, and that 8,489¹ of these were undergoing sentences of five, seven, and ten years, and I assume for the purposes of this paper that a totally unskilled but able-bodied prisoner can become expert,—as a labourer in one year, as an excavator in one and a half years, and as a quarryman in two years.

It is no mere assertion on my part that the construction of certain descriptions of harbours of refuge does afford unusual facilities for utilizing convict labour; it rests upon the experience of the employment of convicts for upwards of fourteen years in the construction of Portland Breakwater and Harbour works, which is perhaps the most successful construction of its kind, and upon their employment upon several similar constructions abroad.

In a paper read before this Institution in March, 1875,² by the eminent Civil Engineer by whom these works were constructed, it is stated the cost per acre of sheltered anchorage, taken over the deep water portions, was—

	£
At Portland, built with the aid of convict labour	800
„ Plymouth.....	1,897
„ Holyhead	6,425
„ Dover	12,755

The difference in cost is of course only to a limited extent attributable to saving consequent upon the employment of convict labour; much is no doubt due to the advantages the harbour of Portland owes to nature in respect both of form and of depth of water, as well as to the position and description of the adjacent beds of stone of which the breakwater was formed, and the mode of construction adopted; but still, crediting these as largely as you may, enough remains to point to a decided economy from the employment of convict labour.

I may remark here that the so-called island of Portland is an exceptionally excellent position for a prison establishment. Its almost isolation from the adjacent land of Weymouth, with which it is connected by a narrow beach of shingle, $2\frac{1}{2}$ miles in length, renders

¹ 3,045.....	5 years.
3,637.....	7 „
1,807.....	10 „

8,489 Total.

On "Military (or Strategic) and Refuge Harbours." By Sir John Coode, Kt., M.I.C.E. Journal, vol. xix, No. LXXXI.

escape in that direction well nigh impossible. Elsewhere it is washed by an unkind sea. The form of the "island" and the absence of trees, which offer nearly the whole of it to observation from its highest point, combined with the paucity of the inhabitants and their habits of reserve, render the maintenance of discipline an easy task.

It is difficult to find another position which lends itself so conveniently to the employment of convict labour, but I shall by-and-bye be able to indicate at least one position that is not far short of it in such natural advantages.

It may be said that in undertaking any new work by convict labour it will be indispensable to erect Prisons with the necessary accessory buildings, that the cost of these will be very great, and so far unnecessary that in all probability, seeing that the number of prisoners shows no sign of annual increase, the existing prison accommodation will be sufficient for prison purposes for years to come.

In the Report already alluded to, it is stated that in the quinquennial period 1877-82, while the population of England and Wales has increased by $1\frac{1}{2}$ millions, the number of prisoners (convicts) has actually decreased; it is less by four in 1882 than it was in 1878.

Though it does not enter into my subject, I may be permitted to observe here that this is a most gratifying result; there are other gratifying results recorded in this Report, especially the diminution in the proportion of younger criminals, but I may not dwell upon them now.

Before dealing with the cost of a Prison Establishment, I would remark that after all economy is secondary to the industrial and reformatory employment of prisoners; nevertheless, admitting that the cost of a new Prison Establishment is unremunerative expenditure, it is but a small portion of the expenditure upon a large work such as a Harbour of Refuge.

The Royal Commission of 1879 on the Penal Servitude Acts observe upon this point: "No doubt, even if it were not advantageous in a pecuniary point of view to employ convicts upon public works"—such as Portland Harbour works—"it would still be most desirable that such employment should be found for them, as an essential part of penal discipline."

Assuming that a prison establishment for 1,000 prisoners would cost 75,000*l.*, this would represent the first charge for the employment of 1,000 prisoners upon a great Harbour of Refuge, after which the annual charge for prisoners, no matter how long the duration of the work, would be about 4,500*l.* per annum.

From the same Report it appears that the average annual charge¹ to

¹ Annual charge:—	£ s. d.
Portsmouth	9 12 1
Borstal	7 4 11
Chatham	1 12 3
	<hr/>
	18 9 3
Deduct for Portland.....	0 13 3
	<hr/>
Total.....	£17 16 0
	<hr/>
Average per prisoner.	£4 9 0

the country per prisoner in the four prisons of Portsmouth, Borstal, Chatham, and Portland is 4*l.* 9*s.*, after defraying the salaries, and charges, for the staff, for victualling and clothing of prisoners and their officers, for repairs to buildings, and all incidental charges.

The more quickly the work is executed the less will be the charge for labour, for plant, and for such supervision, and there must be some such, as is entirely civil.

Let us assume that the percentage of labour in such a work as we are considering is 25 per cent., and that a prisoner does about two-fifths of the work of a free man, the saving arising from the employment of prison labour will be 10 per cent., but the contractor's profit will also be saved, and this may be set down at 10 per cent., and so will a portion of the charge for superintendence, say 2·5 per cent.; so that the net saving arising from the employment of prison labour may not unfairly be stated at 22·5 per cent., which in a work costing 1,000,000*l.* amounts to 225,000*l.*

Setting the cost of a prison establishment¹ at 75,000*l.*, and the sum of the annual charge for twenty years, reckoned at 4,500*l.* per annum, at 90,000*l.*, the saving above is reduced to 60,000*l.* Probably a large portion of this will be absorbed by the enhanced charge for plant, which charge will rise with the length of time in which the work is under construction, and by the increase in the charge for insurance against damage from storms, which will rise also, but in a still greater degree, with the time the work is under construction.

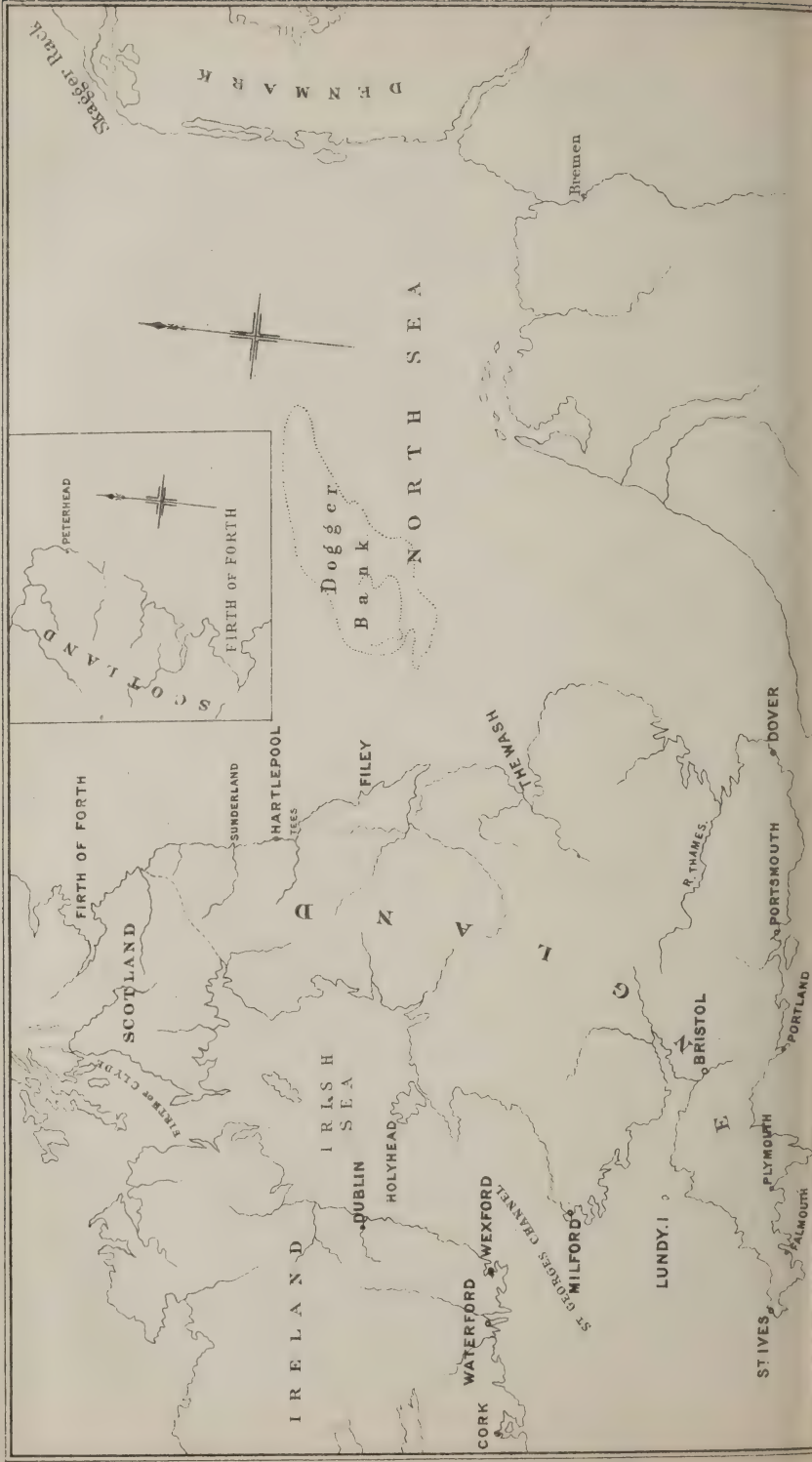
So that even if there be little or no saving, it may be confidently stated that there need be no loss, consequent upon the employment of convicts, even if they consume, which is not improbable, twenty years in doing what might well be done by free labour in twelve years.

But, after all, extreme rapidity is not a matter of vital importance in such constructions, as the water which they enclose can be made use of by shipping while they are in progress. Moreover, the employment of prisoners is attended with this further advantage, viz., that Government retains the work in its own hands, and is at liberty to vary at pleasure the design to meet unforeseen circumstances, and in such works, even with the most careful prevision, every circumstance will never be foreseen, whereas if the work were placed out at contract such variation would be inadmissible, or would give rise to extra cost and constant dispute.

The subject of Harbours of Refuge has been so long before the public and has been so much discussed that it is no longer a question of whether they are needed, the question is where they are needed, and in choosing a position for such harbours the still existing tendency of ships to increase in size cannot be overlooked, as this, by rendering very large and open harbours a necessity, practically very much lessens our choice.

It might, indeed, be thought that steam would have rendered vessels to a high degree independent of weather, and that so the necessity for Harbours of Refuge would be less, but this does not, I think, prove to

¹ For 1,000 prisoners.



be the case; there are various classes of steam-vessels built, and if true of the highest classes and of the best of their classes, it is by no means true of the older and of the inferior classes, which not only make indifferent weather, but are manned by less efficient seamen than were the sailing vessels of the past time; moreover, the smaller coasting and fishing craft have to be cared for as much as ever.

But a Harbour of Refuge should be available for the ships of Her Majesty's Navy as well as for trading ships, and, therefore, should not only be placed conveniently for their use, but be of a construction to meet their wants.

If you direct your attention to the map of Great Britain, you will see that the East coast claims the first consideration, the South coast is already well provided, and the West coast, which is not so much exposed as the East coast, has already three points of refuge.

When this subject was last before this Institution, and I may say was last prominently before the Public, the claims of the East coast were obscured somewhat by Dover Harbour, but the recent resolution of Government to complete this harbour has removed it from the sphere of discussion, and there is no longer rivalry between the two.

When I commenced to consider this subject, I had it in my mind to leave untouched the military aspect of the question, but I soon found that it was impossible to disconnect civil from military considerations, inasmuch as the very circumstances which tend to collect the shipping of the Kingdom to one spot, either as a place of refuge or as a port of call, render that spot an objective point for an enemy, and, moreover, in many cases at least, the facilities of water and of land, which serve to render particular sites eligible or preferable as Harbours of Refuge, serve also to render them good Bases of Operations for an enemy.

It is impossible, then, to discard from consideration the military aspect of the question, and I am the more satisfied with this conclusion, as the eminent Civil Engineer who dealt with this subject in this Institution in 1875 found here strong ground.

I mention this lest civilians, if such there may be here to-day, should carry away the impression that a military man can only treat a subject from a military point of view.

The military considerations which at once suggest themselves are,—that it should be possible to prevent an enemy from entering or obtaining possession of the Harbour, or, indeed, from destroying from a distance the shipping collected therein;—this is a matter of some difficulty in these days of long-ranging guns and of armoured ships;—that if, unfortunately, he has succeeded in getting possession of the Harbour, he should not be able to remain in it; these two considerations require for their fulfilment a particular form of Harbour, which in its turn needs, or is best attained by, a particular coast line, and by a particular configuration of the ground which surrounds and shelters the shore.

It has been already stated that the South coast is well provided with Harbours of Refuge; it has three artificial Harbours, all of the first class, Plymouth, Portland, and I suppose I may include Dover,

with the outlying Harbour of Alderney; it has also the great natural Harbour of Portsmouth, and the minor Harbour of Falmouth.

Upon the West coast there are Milford Haven and the Firth of Clyde, with the intermediate harbour of Holyhead, so that upon this coast there is already some refuge, but upon the East coast, for a distance of 405 miles, viz., from the Thames to the Firth of Forth, there is no Harbour which ships can make in all weathers, or in which they can coal with absolute certainty in all weathers.

The intermediate Harbours either are not suitable for the vessels of the great size of the present day, or are difficult to make in bad weather.

Yarmouth Roads, in which Nelson's fleet lay so long, and which was often the rendezvous of our fleets, has lost its usefulness in consequence of changes in the sand to which the roadstead owes its existence, the southern entrance having become "barred" to vessels of size, and the northern entrance having become prejudiced by patches of sand.

Hollesley Bay is no longer suitable for large vessels.

Harwich Harbour has only 16 feet of water at low water, and the entrance is through a narrow channel with a sharp turn in it.

The Humber, with wind from the eastern quarter of the circle, is not a water in which vessels may ride with safety.

The Tyne is the outlet of a small river, and no vessel could attempt its entrance in certain weather, or could remain in it with comfort, if it succeeded in entering.

I believe I have fairly summarized the Harbours on the East coast, and it is sufficiently evident that not one of them will satisfy the conditions essential to a Harbour of Refuge.

Careful consideration and personal examination of this coast have led me to the conclusion that the Royal Commissioners of 1859 were right in recommending Filey as the place for a Harbour of Refuge on the East coast.

Moreover a deliberate consideration of the evidence taken by the Commissioners impresses upon me that the balance of advantages is in favour of Filey. But I set great store by the opinion of Admiral Sir James B. Sullivan, one of the Royal Commissioners; with some experience both of naval and military surveyors, I have never met anyone whose eye for ground, if I may use the expression nautically, was so good; he strongly recommends Filey as satisfying the conditions of a Strategic Harbour, as well as of a Harbour of Refuge; he points out that in addition to its advantages of position, it is within reach of our numerous coal-fields, and he mentions, one very conclusive fact, to my mind at least, "that while each witness said his own port was the best, they all said Filey was the second best."

There are no dangerous banks or shoals in the neighbourhood of Filey; the coast here compares in this respect favourably with other parts of the East coast.

Filey might become a great rendezvous for fishing-vessels; it is 60 miles from the Dogger Bank, and the centre of the best fishing-ground on the coast of Great Britain.

The bottom in Filey Bay is Speeton clay, similar to the Kimmeridge clay at the bottom of Portland Bay, and is of a singularly tenacious character.

For strategic purposes Harbours of Refuge require development in other directions; they should have facilities for coaling, abundant supplies of water, plenty of wharfage, and ample means for the embarkation and disembarkation of troops, horses, guns, and all the munitions of war, and for this purpose they should be in direct communication, by rail and by telegraph, with the military centres and arsenals.

It has been estimated that a Harbour of Refuge of the most ample dimensions may be constructed at Filey for 1,000,000*l.*; say that it will cost 1,250,000*l.*, this sum, large as it is, is a mere trifle, somewhere about $\frac{1}{16}$ th per cent. upon the annual foreign trade of the country, which may be roughly stated to be at present 700,000,000*l.* with no upward tendency.

From the Returns made to the Board of Trade, of sea casualties, which occurred on the coasts of the United Kingdom, or were reported as having been met with Abroad, I find that last year the total losses of vessels were 1,303 of, in the aggregate, 378,424 tons, of which 174 were steamers, of, in the aggregate, 103,284 tons, and 1,129 were sailing vessels, of, in the aggregate, 275,140 tons; and that in addition to this there were 1,622 serious casualties, to 508 steam, and 1,114 sailing vessels, of, in the aggregate, 696,971 tons, by which much destruction was wrought to both vessels and cargoes; also that there were 3,470 minor casualties to 1,039 steam, and to 2,431 sailing vessels of, in the aggregate, 1,140,123 tons, of which it is not necessary to take notice here.

The gross total of British vessels lost or injured last year (1881-82), was 6,395, of, in the aggregate, 2,585,418 tons.

Going back to the total losses, if we value the classed steam and sailing vessels at 12*l.* and 8*l.* per ton, respectively, and the unclassed vessels, though these are probably classed in the smaller registries, at 10*l.* and 6*l.* per ton, respectively, the loss of property in vessels alone amounts to 3,265,656*l.* It would not perhaps be far wide of the mark if their cargoes were valued at one-fourth as much more, in which case the value of the property lost would be 4,082,070*l.*

It is very difficult to assign a value to the damage done to the shipping which suffered serious casualty, at least without spending over the Tables issued by the Board of Trade more time than I have had at my disposal, but the value of the vessels alone, calculated as above, is 7,087,640*l.*, and estimating the cargoes as before, and that both suffered depreciation of one-fourth,—the value of the property so lost would be 2,214,887*l.*, and the loss last year in British vessels at home and abroad may be stated at over 6,000,000*l.*

It is proper to observe that the casualties last year were above the average.

It would appear from the same Tables that the British vessels, lost last year on or near the coasts of the United Kingdom, were 444, amounting, in the aggregate, to 70,214 tons,—and which suffered

serious casualty were 615, amounting, in the aggregate, to 146,830 tons; using the same method of calculation as before, the gross value of the property lost on or near the coasts of the United Kingdom was 1,615,726*l*.

But if allowance be made for 82 and 104 foreign vessels, of, in the aggregate, 13,000 tons and 24,471 tons respectively, which were lost and suffered casualties on the coasts of the United Kingdom, the amount of property lost rises to 1,806,903*l*.; and if we assume that two-sixths of this was lost between the Forth and the Thames, the gross total of property lost upon this portion of the East coast may perhaps be set down at 722,760*l*.

In the same year 1,097 lives were lost upon the coasts of the United Kingdom; of these 289 were lost between the Fern Islands and the North Foreland, between which places 121 vessels were lost, and 213 vessels suffered serious casualties.

I am far from saying that these lives and this property, or even the greater portion of both, would have been saved to the nation if there had been a Harbour of Refuge in the centre of this danger-fraught and unprotected coast; but I do say that if there were a Harbour of Refuge there, we might with reason anticipate an important diminution in these melancholy figures.

But the 1,097 lives lost by no means represent the dangers which lie about our coasts; in the same period 4,066 lives were saved from shipwreck; and the total, 5,183, which represents the number annually in mortal and preventible peril, may well spur us on to spare no means which afford a hope of mitigating this peril.

It has been already stated that the total of the Foreign and Colonial Trade of the United Kingdom was last year 694,155,264*l*.; deduct from this the trade of London and Liverpool, 394,264,025*l*.; of the remainder, 299,891,139*l*., one-third belongs to the East coast between Berwick and the Thames; the exact figures are 96,118,898*l*.

But judged by the tonnage, the coasting trade on this part of the coast is nearly, if not quite as much more, so that possibly the passing trade may be set down at 190,000,000*l*. annually.

The Foreign and Colonial Trade of the East coast is nearly twice as large as that of the South coast, and about $4\frac{1}{2}$ times as large as that of the ports of the Bristol Channel, the exact figures for these being 50,606,421*l*., and 22,896,283*l*. respectively.

In the gale of autumn 1880, the wind blowing from the north-east, many vessels were wrecked and 164 lives lost upon this coast, and a large number of these were lost south of Filey between Flamborough Head and the coast, having been driven down and wrecked for want of shelter.

In the gale of October, 1881, wind blowing from the north north-east, 36 vessels out of a total of 45 were wrecked between Berwick and the Wash.

It must be conceded then that the East coast, between the Thames and the Forth, a distance of 405 miles, claims first attention.

1. Because it is unprovided with any Harbour of Refuge.
2. Because its passing trade is far in excess of that of any

qual extent of coast (excluding the mouths of the Thames and the Mersey).

3. Because the proportion of casualties is greater thereabouts than upon any equal extent of coast, excluding the Thames and the Mersey.¹

Great energy has been manifested, and much money has been spent in improving the local Harbours at the principal ports of this coast, but they do not supply the want. This is clearly shown by the return of casualties in the rivers and harbours of this length of coast, which are 28 of the casualties in the rivers and harbours of the United Kingdom, the mouths of the Thames and the Mersey being excluded; and the Royal Commissioners of 1859 state that the preponderance of evidence—being that of thorough seamen and highly intelligent men, the greater part of whose lives had been passed at sea upon the coast,—was in favour of a Harbour of Refuge at Filey, as that which would prove most conducive to the saving of life.

It appears, moreover, that fishermen from all parts of England resort in the autumn² to this coast to engage in the herring fishery, and that no other spot would be so convenient for refuge for them.

The Commissioners add that for convenience as a port of call, for the collection of convoys, for security from attack, and for a naval station, every advantage would be afforded by the position of Filey.

In this I thoroughly agree with them, and I will add that the nature of the bottom and the complexion of the adjoining coasts are such that there is little likelihood of a Harbour there silting up.

Moreover the locality is very suitable for the employment of prison labour.

The country is open and thinly inhabited, there is an excellent position for a Prison Establishment a little in rear of Filey Point, upon level ground of moderate elevation, 100 feet above the level of the sea, which may be easily cut off from the world by a very modest expenditure of fencing. The point itself is a hard oolitic stone of fairly good quality,—the middle oolite,—easily worked, but very enduring in water, in fact very similar to the stone at Portland of which the breakwater there was made, and the process of construction would probably follow the same lines, viz., quarrying near the point, running

¹ Take for instance the fishing trade: eleven-twentieths of the fish caught in the United Kingdom passes inwards through four ports of the East Coast.

In 1878 the quantities passed through these ports were:—

Grimsby.....	59,407 tons.
Hull	26,938 „
Scarborough	7,133 „
Whitby	3,600 „

97,078 tons.

The total now, 1883, probably much exceeds 100,000 tons.

In 1859, 600 boats and 5,000 men were so engaged. In 1876, the number of boats of 15 tons and upwards was 953, with an aggregate tonnage of 52,119, in number one-third, in tonnage two-fifths of the fishing boats of the United Kingdom.

the quarried material down the inclination formed in quarrying, and depositing the material by tipping it into the water from a timber staging, or possibly by means of hopper barges. A portion of the upper part of the breakwater would probably be constructed of either squared stone, or Portland cement concrete blocks made with broken local stone, making use as far as possible of the natural ledge of rock called Filey Brigg, which is indeed a continuation of Filey Point, and run out for about 1,100 yards in a direction most suitable for the commencement of a breakwater.

This ledge was turned to such a use by the Romans, who made a harbour here, the remains of which are still to be seen under water.

As far as the security of the prisoners is concerned the position here is almost as favourable for a Prison Establishment as the position at Portland.

Strategically Filey is most convenient; it is almost central, it is the same distance from the outlet of the Baltic and from Bremen, and it is nearer than the Forth to the outlet of the Baltic, while it is almost the same distance from Bremen as Dover; it is therefore the very best place for protecting the coast, while it is also the best place for commencing offensive operations towards either of the localities indicated.

This will be clearly seen by an examination of the accompanying diagram.

Defensively it is much favoured; the Front of the proposed harbour from Reighton to the point would probably be 6,000 yards in length, and as the breakwater would probably have a saliency of 1,600 yards in advance of this Front, advantage might be taken of the saliency for an advanced work on the breakwater, the flanking works being placed on Filey Point and about Reighton.

The wolds overlooking the bay are open and rolling, and afford good fighting positions, in the event of a hostile landing being made either above or below Filey, while favourable sites can be found on them for defensive works; these works should be constructed by the convicts as the harbour works proceeded, and need not be very costly.

Upon the West coast of England the recommendations of the Royal Commissioners of 1859 appear to have been limited to that part of the coast between Land's End and Hartland Point, considering doubtless that the upper part of this coast was sufficiently provided for by Holyhead, and by existing smaller harbours, mostly upon the Irish coast, in the improvement of which they proposed to spend about a quarter of a million.

The expediency of spending so much upon these smaller harbours is, to my mind, doubtful; in some of them the water is so shallow and circumscribed, and the entrance so narrow, that after all is done the accommodation must be of an inferior character.

But between the Land's End and Milford Haven some refuge appears to be wanted, and though St. Ives Bay, the position selected by the Commissioners, is good, it does not appear to me as good for commercial purposes as Lundy Island, from which their favour seems to have been diverted by the expense of construction consequent upon

the depth of water round it; the depth to be dealt with varies from 10 to 12 fathoms.

It certainly is not as good strategically, for Lundy is central, and is not as good a position for the employment of convict labour, for which a small island standing away from the coast in deep and often troubled water seems in every respect suitable; if the work be performed by convict labour neither expense nor time need be main considerations, especially as discipline can be well maintained, and the place must be exceptionally healthy.

Moreover, the area proposed to be enclosed at St. Ives, at an estimated cost of 140,000*l.*, is comparatively insignificant, amounting together to 180 acres, of which not 100 acres would be available for the largest class of vessel.

For the southern portion of the West coast I propose Lundy Island, and, strategically, this part of the coast will then be well provided. If you cast your eyes for a moment upon this diagram, you will see that the waters here will be strongly guarded, and that the important places higher up the Irish Channel, to which they give access, are cared for.

The strongly fortified harbours of Cork and Milford, and a well-defended national Harbour of Refuge at Lundy Island, with Waterford, a defended harbour for swift vessels, of lighter draught of water, but heavily armed, a little in rear of the centre, form a military position so unassailable, that I doubt an enemy's attempting it.

But after all the necessity, either on commercial or strategical grounds, for a Harbour of Refuge here, is not nearly so pressing as it is at Filey; probably, too, with Dover and Filey on hand, there will be no convicts to spare for such purposes for some time to come, and Lundy may well wait.

I am aware that places other than those recommended by the Royal Commissioners have found strong local advocates, and since I have been engaged upon this subject I have received communications with reference to some places. In some cases my want of knowledge of the locality has unfitted me for their consideration; in others, the proposals were so evidently guided by local wants that they seemed foreign to the subject of this discussion, and if, therefore, I do not bring them forward, it is not from want of courtesy to my correspondents.

Moreover, there is a feeling upon the part of some shipowners that Harbours of Refuge are not an unmixed good, to quote the words of the Provost of Montrose, in these times shipowners do not like Harbours of Refuge, and do not want their ships to go to harbour if it can be avoided.

In one sense that is a right feeling, especially if it should lead to ships being well found and carefully manned; but whether or how far we may give our assent to such feeling, it is evident that Harbours of Refuge may be easily multiplied too far, while for strategical reasons the fewer they are, enough being provided, the better; our fleet is not numerically very large, the Colonies and the great water highways of our carrying trade must demand a large portion of it for

their safeguarding, and it is above all things expedient to retain the ships which remain in as little divided a state as possible; a few well-chosen strategical positions in which our ships can, if necessary, find shelter, coal, and water, with munitions of all kinds, and from which they can operate in masses large enough to keep an enemy's attention rivetted upon them, afford the best guarantees for the defence of these islands, and for retaining in our own control the enveloping waters which have hitherto been our best protection.

Thus may, to use the Laureate's words—

“ Her throne be kept unshaken still,
Broad based upon the people's will,
And compassed by the inviolate sea.”

Captain Sir GEORGE NARES, K.C.B., R.N., Board of Trade : It is impossible offhand to criticize in detail such an important paper as we have had placed before us by Sir Charles Nugent. However, before any remarks are made upon it, I would take exception to the wording of the heading. It is termed “Harbours of Refuge in Connection with the Subject of Convict Labour.” Sir Charles tells us that we cannot employ with advantage less than a certain number of convicts, and that the harbours that they construct are not to be considered in connection with the time occupied on the works. Now I say that you cannot thus couple harbours of refuge from storms, with convict labour, although you may so connect large strategical harbours where the constructive works can be carried on for a large number of years. For instance, we are told that perhaps in twenty years we shall have Dover completed. Are we to wait all that time for the important harbour at Filey, which, as Colonel Nugent tell us, is wanted not only by the nation, but by the fishing and maritime population? If constructed by convict labour it will be the next generation before it will be even commenced; are we to wait all that time? We are told that the number of people connected with the mercantile marine at home and abroad is 160,000 seamen and boys, and that our fishing population numbers some 124,000 seamen and boys. Now if we deduct the number engaged in the foreign trade that are actually absent from Great Britain, it follows that there are at any one time a greater number of men employed in the fishing boats dependent upon harbours for refuge from storms than there are in the larger vessels engaged in the coasting and foreign trade. What we most want for refuge purposes is a large number of small harbours all round the coast for the men engaged in the fishing boats and smaller coasters.

Captain T. A. SWINBURNE, R.N. : I wish to make an exception with regard to Filey. I think it would be very much more advantageous to have the harbour of refuge in Tees Bay. Tees Bay is the weakest part of the British coast, Middlesbrough, Hartlepool, Sunderland are all unprotected. That would be the great centre both as a harbour of refuge and a harbour for coaling and supplies of all kinds for our ships; what is more it is in a bight on the east coast, and the deepest part of the bight in Tees Bay. Ships taken with an easterly wind of course run for the bight. I think the harbour should be at Tees Bay and not at Filey.

Admiral Sir ERASMUS OMMANNEY, C.B., F.R.S. : The chief points to be considered in the employment of our convict labour are those connected with Imperial and commercial interests, those connected with the punishment of criminals, and also with their reformation. Taking all these points into consideration, I think there is no better return to the nation for the money expended, than that of employing convict labour in the construction of breakwaters or ports of refuge all round our unsheltered coasts. Every breakwater built must add to our national wealth. The only criticism I should wish to make is that there are certain places in which I think convict prisons give a comparatively unremunerative return for the great expenditure upon them. Take for instance Dartmoor Prison. Perhaps, Colonel Nugent, you will inform us what we get in return for the great expenditure of money there compared with what you are now advocating, such as the construction of the harbour of Filey. I have no doubt there are a great many of my brother

Officers here who will bear out the very important Imperial results that we have attained in the work thus carried out. Take for instance the dockyard at Bermuda, and the mole at Gibraltar, and consider what great benefits we now derive from these works as a maritime nation. I quite agree with what Sir George Nares said. It is not only in the completion of our military ports that we can employ convict labour, but there are many points on the coast on which breakwaters would be of essential value for the protection both of our coasting trade and for fishing vessels. Take one point for instance, which I think has escaped your notice. Mounts Bay. There is a reef of rocks there which affords foundation for making a very admirable harbour of refuge, where they could more readily find shelter instead of going to Falmouth. I think that looking at these four considerations, Imperial, commercial, the punishment and reformation of convicts, there is no better return to be gained for this country than by the employment of convict labour in the construction of breakwaters.

Sir JOHN COODE, C.E. : I congratulate the Council and the members of this Institution on the choice that they have made of a writer on this very important subject of harbours of refuge in connection with the employment of convict labour. The paper bears evidence in itself that the writer has dealt with the subject in no ordinary way. His is not a mere theoretical view of the matter, for it was my pleasure, if I may be permitted to say so, one of the pleasantest professional associations of my life, to work side by side with Colonel Nugent for very many years at Portland, he on the fortification branch, and I on the harbour construction branch of that great national work. I was in communication with him I may say daily, very often twice a day, and therefore I know the thorough and intelligent way in which he entered into, and made himself master of all the facts and bearings of this question of the employment of convict labour. If I gathered rightly what fell from Sir George Nares, the exception he took was simply this, that Colonel Nugent has called these harbours, harbours of refuge, rather than strategical harbours.

Sir GEORGE NARES : The Council, not Sir Charles Nugent.

Sir JOHN COODE : Who chose the title I do not know ; but I am of opinion that a strategical harbour on the east coast of England is a great want of the day, and that the subject is one which should come naturally before this Institution. It was from a strategical point of view that I as a civilian (wisely or unwisely) undertook at the request of the Council of this Institution to treat the subject some seven or eight years ago. The views enunciated by Colonel Nugent in this paper are so entirely in accordance with those which I laid down in a professional report—no less I am sorry to say than a quarter of a century ago—with reference to Filey as a commercial harbour, and so fully in harmony with the views which I had the honour of putting before this Institution about eight years ago, that I really have very little to say on that branch of the subject to-day. I should like to be permitted here to say that I cannot yet see why Dover should have priority over Filey. I may be held to be prejudiced in favour of Filey, but whilst I am free to admit the importance of Dover, I see a still greater need for a strategical and a refuge harbour for the mercantile marine and for the fishermen on the east coast of England, and I say that the spot on that coast which *par excellence* is best adapted for such a harbour is Filey Bay. Whether you take it from a national point of view as affording more profitable employment for convicts, or as yielding a greater benefit for the expenditure of a given sum of money, the claims of Filey are, in my judgment, decidedly superior to those of Dover. I think Colonel Nugent was not a little hard upon the Tyne. A great deal has been done on that river, and the Tyne has rendered very good service to many vessels overtaken by storms ; still occasionally when there happens to be a strong easterly gale blowing, and at the same time a considerable quantity of flood water coming down the Tyne, there is what sailors call a “nasty” sea at the mouth of the Tyne, and small vessels do not like then to encounter it. So far I agree with him, but I think he has over-rated that difficulty, because it only occurs occasionally. The Tyne Commissioners have done very good work, and they deserve the greatest credit for the spirit which they have exhibited. I think it would have been more impressive if the author had in his paper added

together the amount of the loss last year in vessels and the loss in property on the coasts of the United Kingdom; the two amount to the large sum of 7,340,000*l*. I think that is a very important, and very serious fact. Then, as to the question of the relative value of the employment of convict and other labour, I may say that for the last thirty-six years, without any cessation or interruption, I have had harbour works in course of construction under my direction (I do not say on one harbour, but on different harbours, extending over that long period) by convict labour in different parts of the world. At this present moment there are four Colonial harbours being carried on under my direction, and from my designs, employing somewhere about 1,000 or 1,200 convicts; I therefore know something of the value of convict labour. Under such circumstances, and seeing that it fell to my lot to organize the engineering arrangements for the employment of convict labour in the first experiment that was made in the country—I mean at Portland—I naturally take something more than an ordinary interest in this convict labour question. Colonel Nugent is perfectly right in saying that from the experience at Portland, extending over fifteen years, with an average of 800 or 900 convicts always employed—the number sometimes amounting to 1,200—the average result was that the work got from the convict amounted to about 40 per cent. of the labour of a free man. I see no reason whatever why, under proper management, you should not get from a convict 50 per cent. of the labour you get from a free man. That applies at home. As far as regards the Colonies, where we employ black labour, the proportion is very different. There we find we can get out of the convict very nearly as much as we can get out of the free native. There is one point which Colonel Nugent most properly called attention to, and that is, the propriety of employing convicts on large harbour work, such as he has been treating of. He has said very truly that there is a large percentage of the work to be done on such harbours which does not require that the labourer should be of a skilled class, and, taken as a whole, it is so simple that the men are very easily educated up to the necessary mark. I think he has perhaps scarcely given the convict system full credit for the saving when he deducts the whole value of the prison. If I understand him, he takes the 75,000*l*., the cost of the prison, and deducts the whole value. It appears to me that if a convict prison is set up with the view that the prisoners will only be occupied on a given work for about ten or fifteen years, it might very well be that certain parts might be constructed in iron, and otherwise so devised that portions might be utilized elsewhere. Of course, as he remarks, owing to the increased time taken by the convicts, there would be a very large absorption, in the plant and establishment charges, of what would otherwise be a saving, because it is pretty obvious that in works of this kind the same establishment and arrangements that will suffice for dealing with 1,000 tons per day, will almost suffice for 2,000 or even 2,500. That absorption was felt at a very early stage at Portland; it was one of the points frequently urged upon the Convict Department, that it was most desirable, on the score of economy, to send out from the quarries a constant quantity, or something approaching a constant quantity, that should be about equal to that which the establishment was capable of dealing with. It is rather a common error to suppose that one can state offhand a general rule as to what will be the percentage of saving by the employment of convict labour as compared with free labour. It is not possible to do anything of the sort; it is not possible to say what the result will be in a given place until you have brought all your arrangements into work. There is, I believe, no other class of outdoor work on a large scale which involves the employment of so small a proportion of skilled labour as that of the quarrying operations in connection with harbours of refuge. The only kind of work that can compare with it in this respect would be a fortification on a very extensive scale, involving simply earthworks, or the quarrying of stone on an extensive scale, as at Portland, where we excavated a ditch somewhere about 120 feet wide, and 80 feet deep, with the double object of obtaining stone for the breakwater, and making at the same time a fortification ditch, and I need scarcely say to this meeting a pretty considerable fortification ditch it was. Very shortly after commencing the breakwater in Table Bay, at the Cape of Good Hope, rather more than twenty years ago, the authorities in the Colony realized the great value of the employment of convicts on a

large harbour work at one spot, and for a considerable period of time, as compared with their employment on roads and bridges, which necessitated their frequent removal and the consequent frequent removal of their barracks from place to place at considerable expense and inconvenience. Assuming a saving of 10 per cent. by the employment of convict labour, which you certainly ought to calculate upon, I think it cannot be disputed for a moment that there is a very great benefit in employing convicts upon labour which, properly regulated, shall conduce to their training to habits of industry; and it should also be borne in mind that in works of this class the employment of prison labour cannot for a moment be held to clash with free labour, as might be the case in other branches of industry. This clashing or interference of convict labour with free labour is a point which has been very much dwelt upon in the country on different occasions, but I wish to call attention to the fact that there can be no such interference in works of this class, because they are such as would never be undertaken by private enterprise, and that in that respect the employment of convict labour on these harbours must be held to be altogether free from objection. Adverting to the question of Lundy Island; looking at the changes in steam-ships and war-vessels, I am strongly inclined to agree with Colonel Nugent that Lundy is a very suitable place for the construction of a large harbour, that would be of great value strategically, and as a harbour of refuge. He said Lundy might very well wait; that was pretty much the conclusion which our Commission of 1859 came to. I should like to say a word with regard to the fisheries: a very important matter. The fish which are caught, landed, and sent away by rail only between Whitby and the Humber, if taken at the rate of 1½d. to 2d. a pound, would amount to about 3,000,000l. sterling annually. With regard to the Dogger Bank, there are on the bank three main fishing grounds: one called the "South-West Patch," another the "Silver Pit," and the third the "Well Bank;" these lie in a little group immediately opposite Filey. The boats fishing there now go to Whitby, to Scarborough, and a few to Hartlepool, but the bulk of them under present circumstances go to Hull and to Grimsby. Bearing in mind the frequent difficulties of getting into the Humber by reason of the strong ebbing tides occasionally aggravated by "freshes" or land-floods, the greater number, if not indeed all these vessels, would make for Filey if there were a safe harbour there; and seeing that the produce of these fisheries represents the national food to the extent of about 3,000,000l. at the present time, and seeing also that the produce of these fisheries is increasing year by year, the importance and the advantage of getting the fish to market at the least cost, and at the earliest moment, and therefore in the best possible condition, will be readily understood and appreciated. May I say one word about Tees Bay? As one of the Commissioners of 1859, I think it right to justify their conclusion. The fact is that our labours were devoted in an especial degree to that part of the east coast of which Colonel Nugent has spoken more particularly, and notwithstanding that three of the members, before the inquiry was set afoot, had pronounced a *primâ facie* opinion in favour of Hartlepool and Tees Bay, the result of that long and searching investigation was that the seven Commissioners gave their unanimous opinion that Filey was the best place for a harbour of refuge on the east coast of England.

Major-General T. B. COLLINSON, R.E. (retired): I think myself very fortunate that I have come back again to this Institution after a lapse of some years just in time to hear this important subject brought to the front again, and particularly that it has happened that my friend Colonel Nugent has been the person selected by the Institution to bring it up; for I do not know anybody, from his long acquaintance with this class of question and his practical experience of Portland and the employment of convicts, who is more fitted to bring it to the notice of the Institution, and whose opinions will have more weight. He has alluded to the past discussions at this Institution upon this subject, and it might be thought that we are fighting old battles over again and using the same arguments once more. But I think we must bear in mind that it requires a long series of repeated naval and military operations to get an idea fixed firmly in the British Parliament. It is only by repeatedly hammering year after year in this Institution that we shall really get progress made. We have now got, I am happy to say, a considerable step in advance; and

that leads me to point out another reason why this is a favourable opportunity for bringing forward this subject again; for during the past year there has been sitting, under the direction of the Treasury, a Committee for considering the question of employing convict labour generally, and that Committee has mentioned three places where harbours of refuge might be formed, and which would be very suitable works for the employment of convicts—one is Dover, the second Fife, and the third Peterhead. They have mentioned the two latter chiefly, I believe, because they were suggested by the great Royal Commission of 1859; and the Government, I understand, have gone so far in approval of their Report, that they have in contemplation the application to Parliament for a sum of money to build a convict prison at Dover, with a view of commencing works there. Therefore I think with Colonel Nugent we may fairly consider that Dover is now wiped out of the question, and that the main consideration for this Institution is, where is the next best place to make a harbour of refuge? I think we should take care to separate well the two ideas of harbours of refuge and convicts, and not necessarily confound them together. I say this, for I observe it has been stated before the House of Commons' Committee now sitting upon the subject of the improvement of smaller harbours, more particularly with respect to the fishing interests, that it is necessary to employ the convicts somewhere, and therefore a harbour of refuge ought to be made. Now I think that is rather putting the cart before the horse. The argument for our consideration should be, is it necessary to have a harbour of refuge? and, if so, where? and then afterwards to consider whether it is practicable to employ convicts upon it. There are three distinct points for consideration in dealing with harbours of refuge: the first is the use of them for large vessels passing upon ocean trade; the second is the local trade; and the third is the use of them for war purposes. Now with respect to the first, the great ocean trade, I shall leave it to other persons more capable than I am to give an opinion as to the best position for the next great harbour of refuge, or even whether it is necessary at all to have one for that purpose; for there seems to be, indeed, some doubt on the part of the mercantile marine whether there is any such great necessity. The existing harbours upon the north-east coast have been considerably improved of late years, especially at the Tyne and Hartlepool and the Tees; and I understand, before long, they expect to get a considerable depth of water at each of those places, and although they are not available at all times they probably will be so at most times, not only for large merchant-vessels but also for unarmoured cruisers. But a more important point, I think, than the question of the ocean trade is the fishing trade; and in that I have been particularly interested of late, for my duties in Scotland obliged me to consider the question of employing convicts upon this proposed harbour at Peterhead; and there I came into connection with the fishing population, and learnt something of the importance of that population to the coast defences of this country. It is not merely the question of supplying cheap food. A great naturalist lately made a statement to the effect that, if we can only get a cheap fish supply, the question of the fishing population is a secondary one. I do not think so; the fishing population is a large one, and a very important one for the Naval Reserve. It forms a large and a powerful part of it, and I am afraid there is some danger, if the question of the fishing trade is treated only from the point of cheap fish supply, that it may decrease; for I understand that the trawlers have driven away some of the fishing population from smaller places on the coast, by being unable to compete with them. The fishing population are the peasant farmers of the sea, and it is impossible for them, under the conditions in which their business is carried on, to provide themselves with the necessary harbours for the purpose. Moreover, one great harbour of refuge will not meet all their wants. What they require is, that several harbours along the coast should be improved, because the fishing-boats have to follow the shoals of fish as they move along the coast. That want, of improving the several harbours, will be to a great extent met by the Committee of the House of Commons, which is now sitting, a part of whose consideration is, I believe, to enable the local places to borrow money at cheap rates from the Government in order to improve their own harbours. Another point for the benefit of the fishing population is getting the fish to market easily. For this purpose I quite agree that Fife comes in for very important consideration. It is not only near one of the

great fishing banks, but it is within reach by railway of some of the great centres of population; and on that point I may mention that a fish wharf, established at Hartlepool not long ago by the North-Eastern Railway Company, has grown to very large dimensions, mainly, as I have been informed, because the fishermen say that they can make three voyages from the Dogger Bank to Hartlepool for every two they would make to Grimsby, and therefore they get a quicker market for their fish. But to make Filey properly available for this purpose the railway communication would have to be improved. With respect to the war requirements in connection with harbours of refuge, the only point I wish to draw attention to is the guarding of the coast by cruisers, and the consequent necessity of having coaling harbours for them. There are at present no really good coaling harbours upon that coast. Although the Tyne and Tees may be available to some extent, they are not always so. Now this is a question that tells very much in favour of Filey, because the great trade lies between the Humber and the Tees and the Tyne and the Forth. That is where cruisers would have to be to guard it, and at some points near those centres of traffic you would require to have more accessible coaling ports for the cruisers to resort to.¹ This, however, is quite a distinct question from that of strategical harbours proper. With respect to the employment of convicts upon these works; if Dover is taken up, that will employ a considerable number of men, but still, as I understand, there will be a large number available for other work, and therefore it would be quite possible to carry on a second harbour of refuge at the same time with Dover. It will be a question of getting money to do it, and not a question of providing the convict labour. As the Home Secretary very pithily said with reference to this question, there are several large spending departments of the Government which require a great deal of labour, and there is one department of the Government which has the labour to supply, and the question is to bring them into contact with each other; and, if Parliament would only give the money, that cannot be done in any better way than by carrying on as many harbours of refuge as you have convicts that can be satisfactorily employed upon them. I do not expect there will be much saving to the Government eventually in the employment of convicts, if you take into consideration their maintenance; but then we must recollect that the convicts must be maintained wherever they are; and if we leave out the cost of maintenance and the cost of the necessary prisons, then there would certainly be a saving, by all the experience we have had, of from one-fourth to one-sixth of the cost of free labour. I have only one thing more to mention, and that is with reference to Peterhead. Although the evidence is very strong in favour of having the next harbour at Filey, there has been a great pressure put upon the Government to construct one also at Peterhead, mainly with the idea of employing the Scotch convicts upon it. Now I venture to think that would be a mistake both for the benefit of Scotland and of the country at large. It seems to me to be very doubtful whether it would be advantageous to have a large harbour of refuge at Peterhead. It can hardly be said to be required for the great ocean traffic, as there is very little traffic that goes round the north of Scotland; and it cannot be said to be required as a strategical harbour, because although we are tolerably well agreed about the advantages of having a strategical harbour on the coast of Yorkshire, I do not know that anybody at the present time is strongly in favour of one at Peterhead, or, indeed, any further north than Filey; and it would certainly not be so great an advantage to the fishing population as would the improvement of several harbours along the coast.

¹ In addition to the above, it will probably be interesting to record the following statistics of the trade at the north-east port, as it affects the question of the position of coaling ports for cruisers:—

I. Approximate value in millions of pounds sterling per annum of sea traffic inwards and outwards—Humber, 53; Tyne, 17; Forth, 12; Tay, 4; ports north of Tay, 2.

II. Approximate tonnage in millions of tons per annum, inwards and outwards. This may fairly be considered as a measure of the number of seamen employed—Humber, 7½; Tyne, 12; Forth, 5; Tay, 1; ports north of Tay, 1½.

Sir DIGBY MURRAY, Bart., Board of Trade : There is one point in the lecture which has not been, in my opinion, sufficiently noticed, and that is the distinction between harbours of refuge and life harbours. I think it must be quite clear, at all events Colonel Nugent's lecture has convinced me if I required conviction, that the establishment of a number of deep-water harbours along the coast in various directions, easy of access, and not fortified so as to render them equal to their own defence, would be a source of very great weakness to this country, especially looking to the number of ironclads that would be likely to be available for the defence of the coast in time of war. Every such harbour, if it was not capable of self-defence, would require to be watched, and where are we to get the fleet from to watch them? I think that Colonel Nugent made a proper distinction between a large military harbour which should be capable of defending itself and smaller life harbours in shallow water which might be available for our fishermen to run into in case of need, but which at the same time would not be capable of harbouring an enemy's fleet.

Mr. F. JOHNSON, Secretary National Refuge Harbour Society : At this late period of the discussion I propose only to make a very few remarks. The point I shall allude to particularly is the question of convict labour. I think it is beyond all dispute that harbours of refuge are needed ; the question is, how are we to get them? We have but three resources, the first is by Government grants, the next is by national loan, and the third by convict labour. In the present state of public opinion it is quite clear that we are not likely to get anything by public grant. If you are to get any harbours generally round the coast there is the very greatest difficulty in getting them by public loan, and for this reason Government has already decided that it does not wish to interfere with the Loan Commissioners. The Loan Commissioners are responsible for the money which they lend, and they do not wish to make any bad debts, and therefore in places of the greatest necessity it is impossible to get a loan as they cannot give approved security ; the consequence is we are entirely left to convict labour ; we have no other present resource. There is no question about it. The resource which is left is an inferior one, and one that, by itself, we cannot expect to get a very large amount out of, but as it is the only resource we naturally fall back upon convict labour. Now, we were told the other day by Mr. Chamberlain that it was from the ranks of the fishermen that we obtain British seamen, who are the defence of our Kingdom, and I think, considering that we have drowned in the last twenty-four years 20,000 men, one of the greatest strategic problems we have to face is how to preserve as large a number of these lives as possible to oppose any enemy which unfortunately might threaten us. Colonel Nugent tells us that on the French coast they are making important harbours, and are setting us an example ; but there is one point must not be lost sight of, and it is this fact, that the whole of the harbours on the French coast are State property, which is not the case in our own country. It certainly is a thing which has impressed itself upon my mind that we should have to take an example in that respect from our neighbours the French, because at the present moment almost every locality is doing everything that it possibly can to get its own members of Parliament to advocate its own particular personal interests, and as long as it is advocated in that way the national point of view is set on one side, and after the Committee which is now sitting in the House of Commons has completed its task we shall have the whole of these particular interests that have been promoted by constituents, and not from a national point of view, brought forward, Government will be embarrassed, and we shall be placed in the same position that we were in some twenty-three years ago, when the last Royal Commission sat upon this question.

Admiral BOYS : Had time permitted I should like to have made a few remarks on the subject of the paper. I will now only detain you one or two minutes. I have had the pleasure of being associated with Sir Charles Nugent for some years on duty of different kinds, and I know that there is no one that the Council could have selected who would have been better able to deal with this subject. There is one condition of a harbour of refuge which appears to me has not been referred to. It is that we must not consider that a harbour of refuge is only a harbour for our mercantile navy to resort to in case of stress of weather or on account of being disabled. It is very probable that in the future, should we unhappily be engaged in

war, that an enemy's cruizer, like the "Alabama," might drop on our coasts unawares, especially on our exposed east coast, with the object of destroying our coasting trade and shipping. Then, what are our vessels to do? They will have to make for the first place they can reach to seek for protection, and that must be a harbour where their enemy cannot follow them. It appears to me on the east coast Filey is exactly that place. With regard to the question of the Tees *versus* Filey, I would simply point out that the subject of this lecture is harbours of refuge in connection with convict labour. It is clear the mouth of the Tees is not a suitable locality for a convict establishment. If Filey did not exist, then I should say let us have a harbour of refuge at Tees Bay; but as Filey does exist, it is, in my opinion, unquestionably the best position for a harbour of refuge on that coast.¹

THE CHAIRMAN: Before asking Colonel Nugent to reply I wish to make one very brief remark, although it refers to a point that has been touched upon by Sir John Coode. I do not think Sir Charles Nugent's description of the Tyne is quite accurate in the present day. The Tyne Commissioners have spent very large sums of money in improving their harbour, and it is hardly accurate to call it a "narrow outlet of a small river, and no vessel could attempt its entrance in certain weather, or could remain in it if it succeeded in entering." Now, as to the entrance to the Tyne, there is never less at the lowest spring tide than 21 feet of water. I think it is a very fair harbour if a navigator knows his position, and is brave enough to run straight in for it with an easterly gale. Of course, a steamer might do that with more impunity than a sailing vessel, but I thought it only fair to the Tyne Commissioners to mention that their harbour is now a very fair harbour, with 21 feet as the least depth at the entrance. I was also going to ask Sir Charles, although it is perhaps hardly fair to ask him to undertake any further labour, whether he could by any means put a little more prominently than he has done the number of ships actually lost on the east coast as distinguished from those that are injured by collisions. As I understand from the figures he has brought before us, and they are very formidable in any way we take them, a great number of the casualties are collisions, and of course have no connection with the question of harbour or no harbour. With these few remarks I will now ask Sir Charles Nugent to reply.

SIR CHARLES NUGENT: I will endeavour to reply as briefly as I can to such observations as have been made upon the paper which forms the subject of our meeting. Some of my hearers, perhaps, did not understand that, practically, the paper only dealt with one class of the harbours which formed the subject of the Report of the Royal Commission of 1859. It seems to me that with a view to define their ground clearly, they made, I will not say an unwise distinction, but a distinction which had not previously received acceptance, and that what previously had been generally understood by Harbours of Refuge, viz., great harbours which ships might make for at any time and in any weather, they do not call Harbours of Refuge. Indeed, I have often been puzzled in reading their Report to keep the facts of it clearly before me, my mind so far having been prejudiced by the common acceptance of the term Harbour of Refuge.

It is perfectly true that much time will be expended if we employ convicts, and looking at the matter at the present time, and feeling how great the need is for harbours of refuge, it, no doubt, seems hard to have to wait, but I fear that that is almost inevitable, and as we have waited in the past, and have after all obtained the result we so much desired, I can only counsel patience in this matter. Captain Swinburne referred to the Tees. I can only say, I am not a

¹ Had time permitted I should have said that I could not agree with the proposal for a harbour of refuge at Lundy Island. It is situated in the midst of the strong tides of the Bristol Channel, surrounded by tide races, which any solid structure in the water would increase and make it too difficult for disabled ships to enter, besides it would be cut off from all outside resources, which is made a necessary condition for a harbour of refuge. With Dover in hand and Filey to come I think we may well leave the question of Lundy Island to be discussed and decided by another generation.

nautical man, and my opinion is not worth much, still I had the good fortune to be associated in the examination of that coast with several very able seamen, Admiral Phillimore, Admiral Boys, and Sir Digby Murray, and others, and although we were able to devote but a limited time to the investigation of some of the Harbours, yet I believe we went to them all. I afterwards went down to examine them myself alone, and my opinion coincides with that of Admiral Boys, who said that Filey is far beyond Tees Bay or Sunderland. In reply to Admiral Ommanney it may be that at the present time convict prisons afford us no good return, and personally I am unable to say what good we have got out of Dartmoor Prison beyond the penal restraint of the prisoners. As far as labour for the nation is concerned I cannot say that we have got much; but I have no experience in this matter, and I did not enter upon this subject with any intention of taking it up. My object was not to show what could be done with prisoners everywhere or how they could be best treated, but simply to point out that certain forms of labour, such as harbours of refuge, were very suitable for the application of prison labour. I would stop for a moment to say how very kind it is of Sir John Coode to speak of me in the flattering way in which he has done, and it is a real pleasure to me that after some years of separation he should retain so kindly a remembrance of me. I am bound, also, to say, that with regard to General Collinson, he has spoken of me in far too favourable terms; indeed, both he and Sir John Coode unwittingly were praising themselves, for, as I have already told you, I have availed myself largely of their labours in this field, and no doubt much, perhaps most, of what is good in my paper comes from them. Sir John Coode did in a certain measure answer Sir Frederick Nicolson, for he said of the Tyne, that with a heavy tide and strong easterly gale you could not make the harbour.

SIR JOHN COODE: Not quite that you could not make the harbour, but that it was very awkward for a small vessel to make.

Colonel NUGENT: I accept the correction, and am also very glad to find that Sir John Coode's experience in the employment of convict labour so much agrees with mine. Of course labour of this kind should not be placed in competition with free labour, and he very early made a point which I had omitted, and that is, that this very form of labour is the form of all others which does not clash with free labour at all. With regard to the remaining value of the prison buildings after the harbour works are completed, I agree with Sir J. Coode that it would be considerable, and should be taken credit for. I purposely abstained from taking credit for it, because such buildings are not useful for general purposes, and I was anxious not to state the case too favourably for the employment of convict labour. While I entirely agree with General Collinson as to the extreme difficulty of influencing the British Parliament, in which conflicting interests are so powerful, I hope with him that Dover is happily wiped out of the question. As to Peterhead, as far as I can judge, the class of trade carried on there does not justify a great national harbour, and strategically I cannot see the use of it, but I entirely concur with him in the importance of this matter to the seafaring population. Moreover, I think the only partial success, if I may say so, of the Naval Reserve, with reference to which the seafaring population must be an important element, is an additional reason why we should not lose sight of that population, but I am afraid that any attempt to keep the members of it spread all along the coast, as I understood was General Collinson's inclination, must fail, for the seafaring population will follow the law of supply and demand. If the trawlers push the seafarers, the peasant-farmers of the sea, out of the market, the seafarers will have to accept their fate, and the smaller harbours must dwindle. Sir Digby Murray referred to my want of distinction between harbours of refuge and refuge harbours, but I said at the outset of my paper I only dealt with the one description of harbour, and that I should devote very little consideration to the other, and that the particular description of harbour would be termed by me for my purpose harbour of refuge. In reply to Mr. Johnson, I think possibly we shall have to fall back on convict labour. Public grants or funds issued by the Loan Commissioners are much more hard to get. I meant to have mentioned the condition of harbours of refuge which Admiral Boys touched on. However, if I did not do so, he has laid it very clearly before you. If I ventured to differ at all, I

think I should be inclined to differ a little with Sir Frederick Nicolson about the Tyne. What I had in my mind was that it was not by any means a sort of harbour which any large vessel, not thoroughly well knowing its position, would care to make in certain weather. I spent a considerable time there, and had the advantage of having official information of what has been done by the Tyne Commissioners, and I am perfectly aware of the noble efforts which have been made, and the very large expenditure they have incurred. I have only to thank you for listening to me so patiently.

The CHAIRMAN: I have only one other duty to perform, and that is to return our grateful thanks to Sir Charles Nugent for this very able and interesting paper. It is manifest from the mass of figures and diagrams he has brought before us that he has expended a very considerable amount of labour in preparing his lecture, and I am sure we are all deeply grateful to him for bringing it before us.

Friday, June 15, 1883.

ADMIRAL SIR FREDERICK W. E. NICOLSON, Bart., C.B.,
Vice-Chairman of the Council, in the Chair.

MACHINE-GUNS.

By Captain Lord CHARLES W. D. BERESFORD, R.N.

The CHAIRMAN: Your Royal Highness, Ladies and Gentlemen: It is with very great regret I have to announce that Lord Alcester, in consequence of indisposition, is unable to take the chair this afternoon. I am very sorry for that on many accounts; especially because his Lordship, as we all know, commanded the fleet when the forts of Alexandria were bombarded, on which occasion machine-guns played an important part. I have been asked to take his place, which I do solely in consequence of my official position as Vice-Chairman of the Council, and not as having any particular knowledge of the very important question we are about to discuss. I have now only to introduce to you Lord Charles Beresford,—if any introduction is necessary,—who, as you are well aware, commanded an active little vessel on the occasion of the bombardment of those forts, and who is good enough to bring before us this very important subject.

FOR a number of years the machine-gun question has been constantly brought before the Royal United Service Institution, and many arguments have been used by some of the cleverest Officers in both Services as to its merits and demerits.

Inventors and machinists have shown the working and the terrible capabilities of their guns, and although the general consensus of opinion, as gathered from reports, appears to be largely in their favour, still, from some cause or another, their immense utility and fearful powers do not appear to be appreciated as much as they would seem to deserve. I propose in the first part of this paper to devote my remarks to machine-guns as applicable to the Naval Service, also to those mercantile ships which, if properly armed, would form such a large and invaluable contingent to the Navy in the event of a war with a European Power. In the latter part of the paper I meant to have added a few more observations to the many that have been made by others, as to the utility of having machine-guns mounted in the field, but time will not permit of my doing so. I am most anxious that my views should be conveyed in the most unprejudiced manner, as to which of the many machine-guns is the best, or in other words combines the greatest number of advantages in its practice and working with the fewest disadvantages, and if my remarks appear to favour one machine-gun system more than another, I hope the reasons given will be most fair, clear, and satisfactory, and not regarded as criticisms on the inventors.

By the 31st March, 1884, the Navy will possess 565 Nordenfelt machine-guns of 1-inch calibre, throwing a solid steel bullet, and principally useful for repelling torpedo-boat attacks; added to this, on

the same date the Navy will possess, or should possess if the contract be fulfilled, 350 Gardiner machine-guns, .45, or rifle, calibre, throwing lead bullets. These numbers, added to the 142 Gatlings already in the Service, will make up the total number of 1,057 machine-guns for the Fleet, amongst which not a *single* shell machine-gun is included. It is proposed to add a large number of quick-firing 6-pr. guns to the armament of the Fleet, and a most excellent proposition it is, as it will do away with the multifarious guns, with their several kinds of ammunition, of all calibres, sizes, and different systems of loading, at present existing in the Navy, and ranging from the 7-pr. to the 12-pr. These last-named guns are all useless for torpedo or other attacks of the present day, owing to their slow firing and equally slow, cramped training, as well as to the bad trajectory caused by their low initial velocity, and their day may be described as past now that the advent of the quick-firing 6-pr. breech-loading gun is so close at hand. A 6-pr. breech-loading gun cannot, however, be described as a machine-gun proper, for the simple reason that the charge is too large to avoid recoil when fired, and recoil means relaying the gun by the sights after each round. A machine-gun proper should have no recoil, and should also be heavy enough to resist any great vibration after being fired, so that the sighting cannot be affected by the discharge of the piece; and when once the gun is laid for an object, the man firing it should be able to fire round after round with the greatest rapidity, and as long as his sights bear, each round would hit the object aimed at to a certainty. The new 6-pr. is, therefore, very properly called a quick-firing gun, and not a machine-gun, and it may be dismissed from our attention at present, as, although it is of the utmost necessity that this gun should at once have a prominent place in the armament of the Navy, and be placed in all ships, particularly small ones, and, further, that a large store of them be kept to arm merchant vessels in case of war, still I do not consider that they can be mentioned fairly in a paper devoted to machine-guns for the reasons already stated.

The danger to the ships of our Fleet cannot be exaggerated if a sudden war broke out, and England had to face a Fleet or possibly combined Fleets of foreign nations, more particularly if the French Fleet was one of those opposed to us. In some classes it is quite undeniable that the French have a better vessel altogether than the English; in all classes they are better gunned, as not only have they the enormous advantage of breech-loaders, but their guns are vastly superior to the English in penetration and rapidity of fire per weight of gun. When comparisons are made between two guns, having nearly the same calibre and weight, these two qualities (the rapidity of accurate fire and great penetration) are the most important to consider; while to add to the advantages named, the French have mounted in their Fleet between 600 and 700 Hotchkiss machine-guns, throwing 1-lb. shell at the rate of fifteen to twenty a minute. Most of these guns were mounted in position in their Fleet before the English had any sort of machine-gun whatever, and some were bought as far back as the year

THE NORDENFELT 1½ INCH MOUNTAIN SHELL GUN.

FIG 1. Side View of Gun and Carriage.

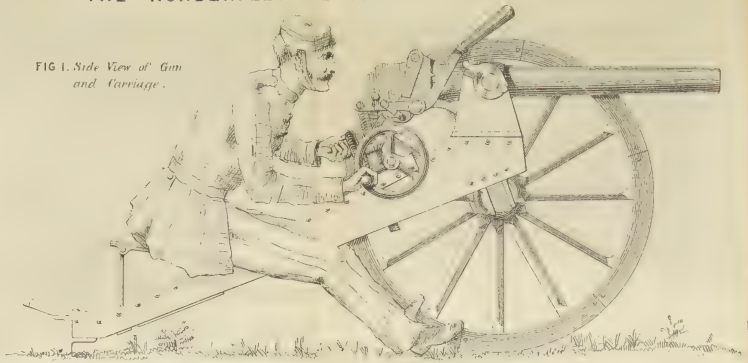
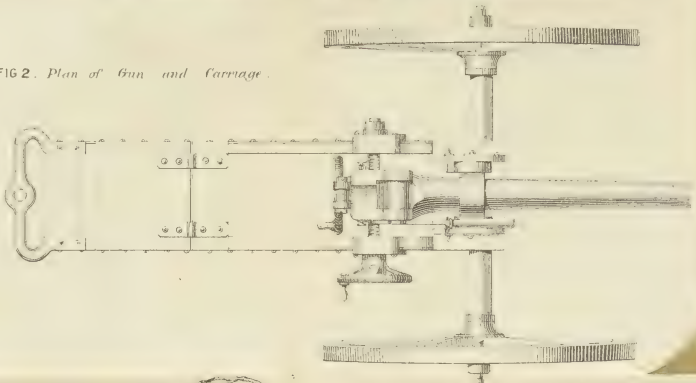
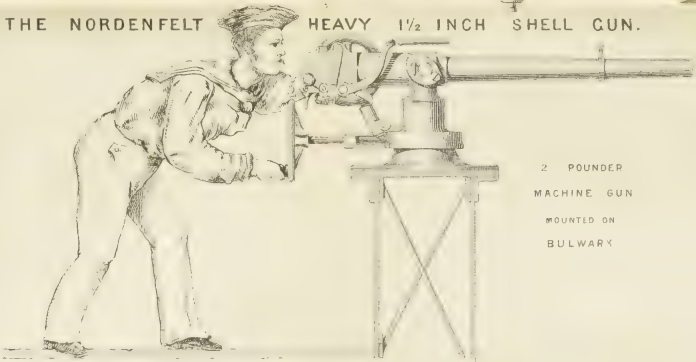


FIG 2. Plan of Gun and Carriage.

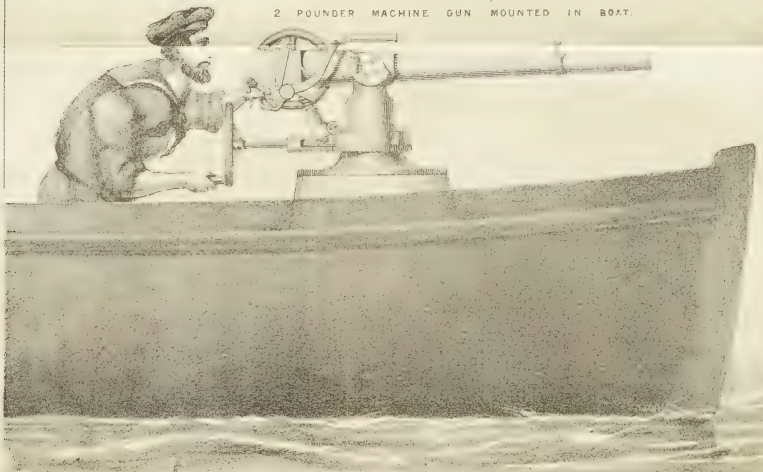


THE NORDENFELT HEAVY 1½ INCH SHELL GUN.



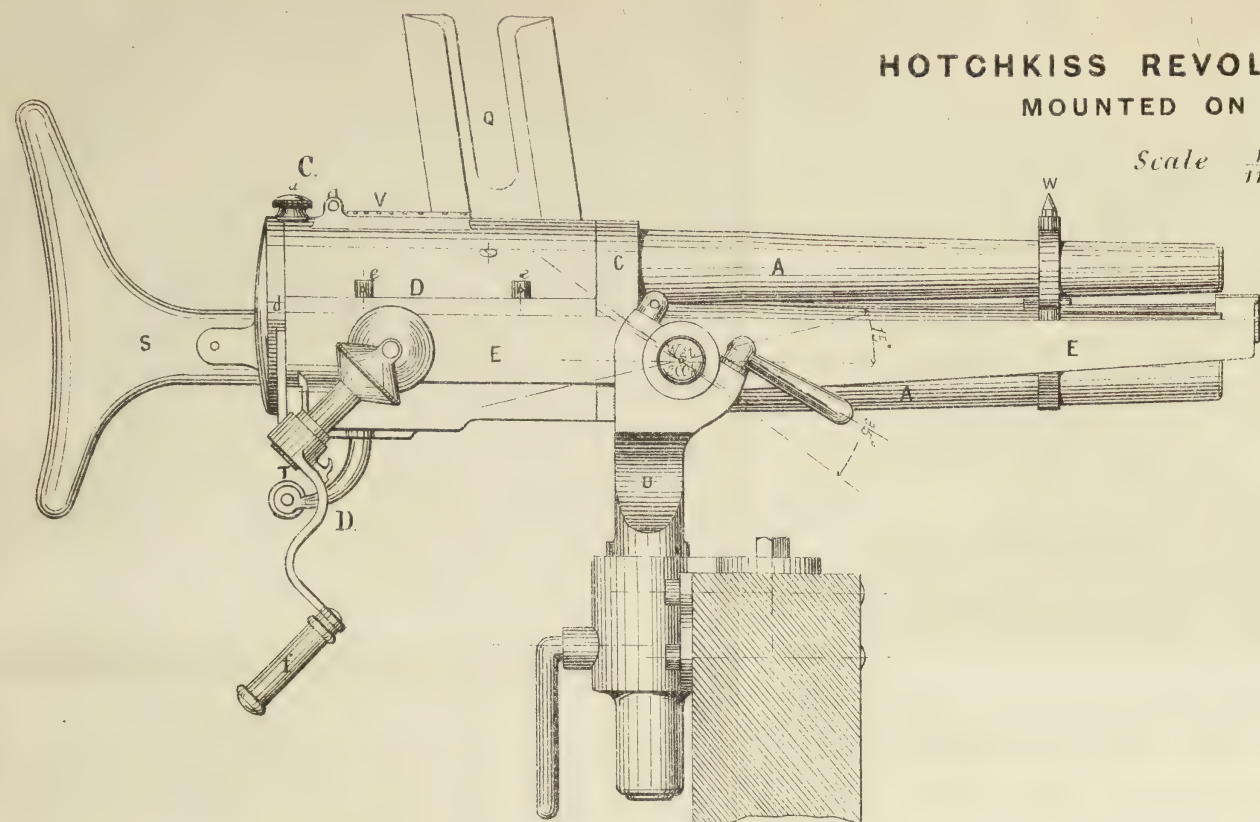
2 POUNDER
MACHINE GUN
MOUNTED ON
BULWARK

2 POUNDER MACHINE GUN MOUNTED IN BOAT.

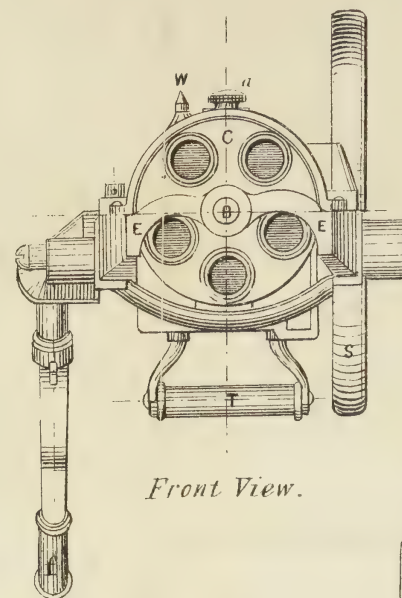


HOTCHKISS REVOLVING CANNON, MOUNTED ON BULWARK.

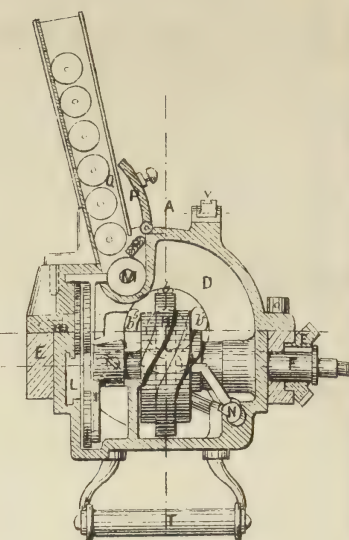
Scale $\frac{1}{11}$



Elevation



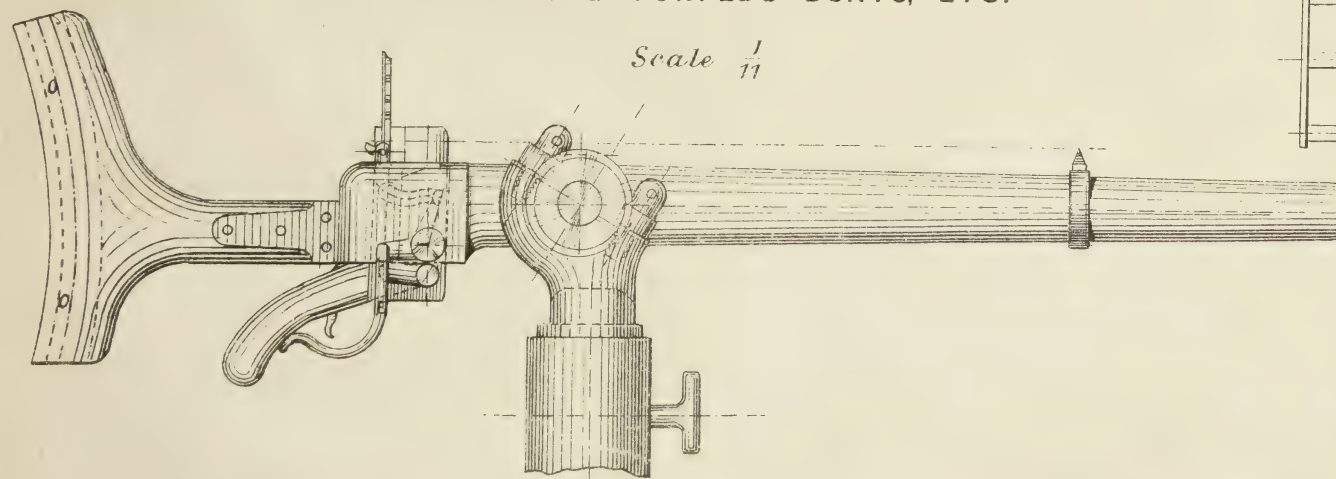
Front View.



Section through C.D.

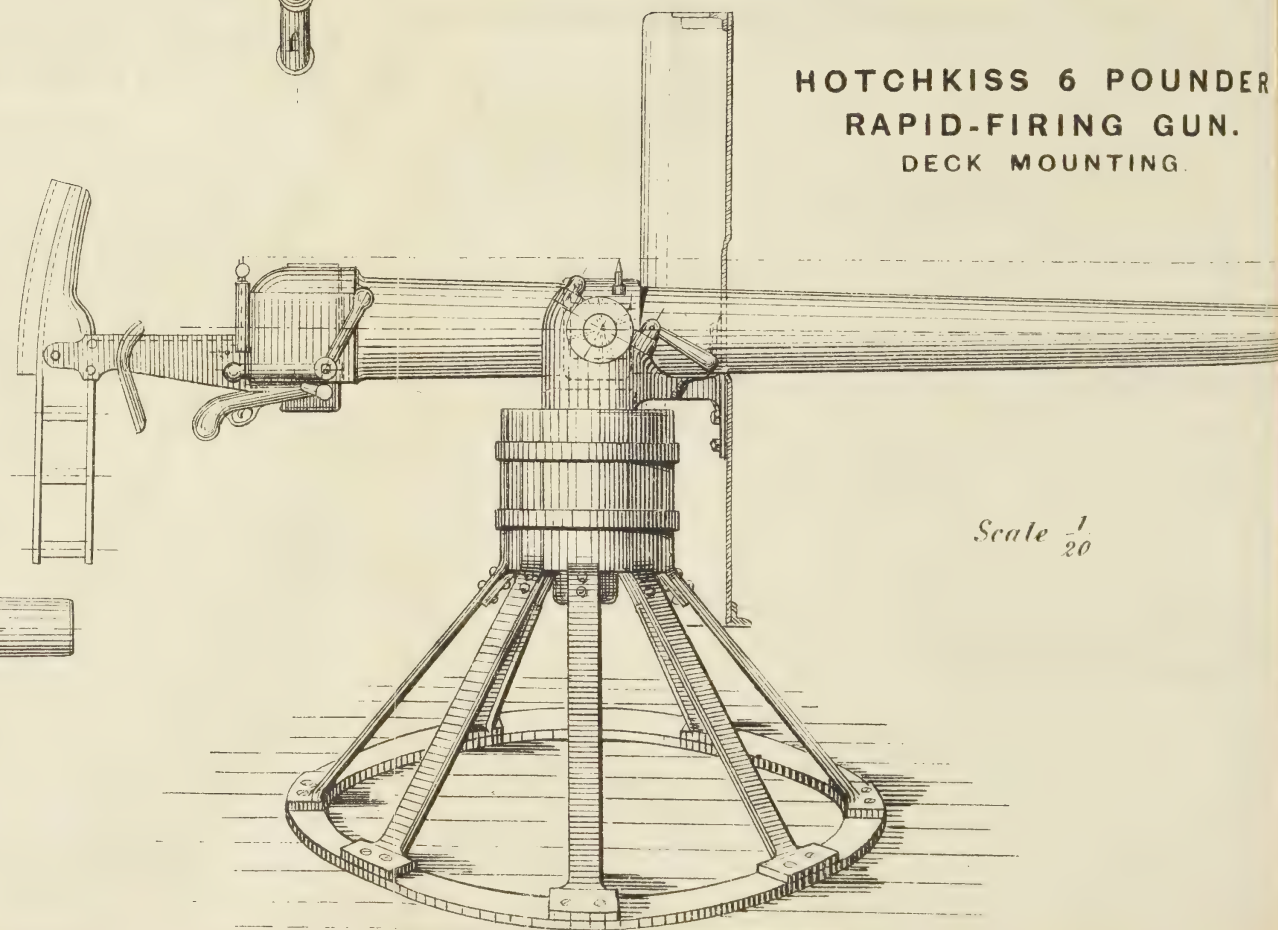
HOTCHKISS ONE POUNDER RAPID-FIRING GUN FOR ARMING TORPEDO BOATS, ETC.

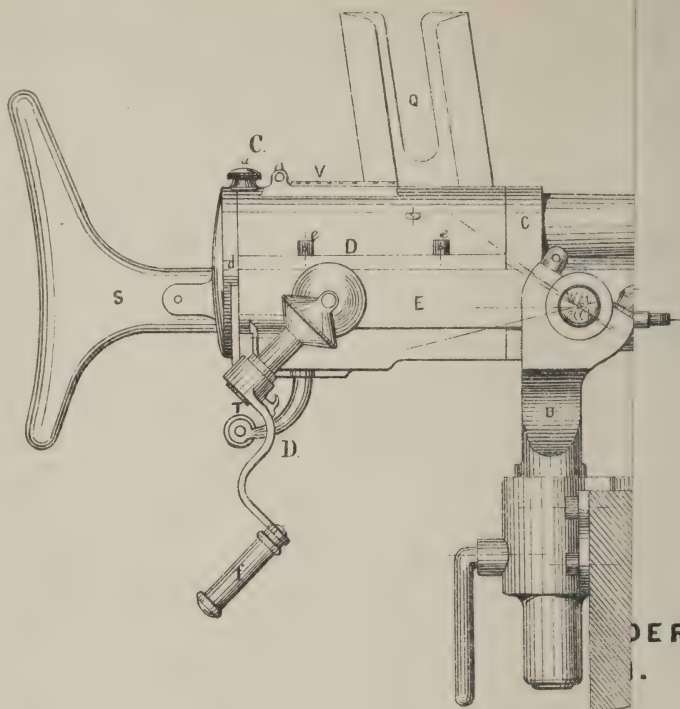
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HOTCHKISS 6 POUNDER RAPID-FIRING GUN. DECK MOUNTING.

Scale $\frac{1}{20}$

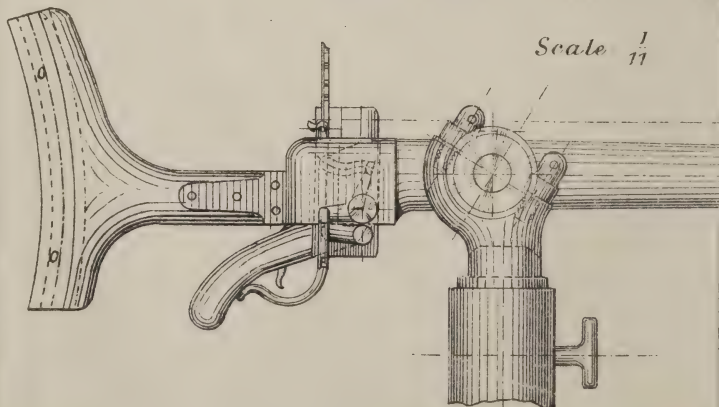




Elevation.

HOTCHKISS ONE POUNDER RAIL FOR ARMING TORPEDO BO

Scale $\frac{1}{11}$



1875. The English had no machine-gun at all till 1878, and have no *shell* machine-gun at this moment. It is needless to point out the superiority that a machine-gun throwing shells would have over the machine-gun which only throws bullets, excepting in the case of resisting torpedo-boat attack, when the bullet-gun is better. The proportion of machine-guns between the two Fleets in another two years may be about two to one in favour of the French, if the present relative rate of progress is kept up, as they determined two years ago to double the complement of Hotchkiss shell-guns to each of their ships. It may be stated here that in all the French *small craft* they have two or more machine shell-guns, whereas the English small craft last year had no machine-guns of any description whatever. The French *small craft* are, however, so vastly superior to ours in fighting capabilities that there could be no doubt as to which would win an action if two ships of similar tonnage were engaged.

The disproportion between England and France, however, in the machine-gun question is still further increased to England's most dangerous disadvantage by all the French machine-guns throwing shells, whereas the English have no machine-guns except those firing bullets. Putting aside the other advantages which all naval Officers will readily allow the French have over us in matters connected with their Navy (but which we hope will decrease as new ships are built and new guns supplied), it is impossible to glance lightly at the question of machine-guns throwing shell. Take two ships at present in Mediterranean waters, the "Amiral Duperré" (French) and the "Alexandra" (English). Suppose the questions of speed, helm, and gun are equal, the "Duperré" will have the tremendous advantage of twenty machine shell-guns, each gun capable of firing fifteen to twenty rounds a minute, and each round being a 1-lb. shell; while to these the "Alexandra" can only oppose eight machine-guns, not shell-guns, but throwing bullets. It must be remembered that guns throwing bullets, though invaluable for repelling torpedo attack for reasons presently shown, are of little use for firing at a ship, or at any great distance, *because the effect of the shot cannot be seen* and therefore the *range cannot be found*, whereas with the shell-gun the range should be got accurately in the first three shots, as it can be seen where the shell bursts. Think of the disheartening and terrible moral effect upon men who whilst they find the enemy improving in accuracy every *second* (there are no minutes in machine-gun fire) cannot themselves see what they are doing, and have no possible means of knowing whether they are firing too high or too low, or where their bullets are going. Likes must be met with likes, and machine *shell*-gun fire from an enemy must be met with machine *shell*-gun fire from us. Bullets are of no use for this purpose for the reasons given.

The French also go on the principle of exposing their machine-guns with a view to getting an all-round and continuous fire, whereas the English prefer protecting the men and guns, and consequently the guns will only bear on a certain small arc. This question is open to

argument, and must necessarily be a compromise whichever plan is adopted. In a duel between a gun having an all-round fire,"and a protected gun, with the all-round and continuous fire which is gained by risking exposure, it would be possible to put the protected gun out of action before it has had a chance of firing a shot at its adversary, the protection limiting its training and preventing the gun's crew from seeing the enemy or getting their gun to bear. On the other hand, the exposed gun may be put out of action the first shot, or the crew disabled, but look at the amount of damage they may have been able to do before that contingency occurs, even if it does occur! It is certain that a rain of machine-gun shells will do more to demoralize a ship's company than a few heavy shot or shell striking, passing through, or shrieking over a vessel, the demoralizing effect of hundreds of these little shells over, in, and about the vessel is very easy to perceive, for all their actions are calculated to upset the nerves of even the steadiest men. The noise of their explosion on hitting the side or the ship inboard, the smoke attending the explosion and the fragments flying around, the shells being poured in perhaps at the rate of three or four in a second, would surely make the most confident and gallant amongst the Officers and crew feel that machine-guns of this description will probably, or it may be said will certainly, seal the fate of an action; add to this the fact that we have muzzle-loading guns, and that some or all of a gun's crew may be put out of action by one or more of the small shell entering the port, also the extreme probability of one of the very heavy charges of powder used now-a-days being ignited by one of them between decks; now combining all these not only very possible but very probable disasters, am I wrong or do I overstate the case when I say "the danger to our fleet *cannot be exaggerated* if a sudden war were to break out and we were found without any machine-guns throwing shell belonging to us?" I have no fear of contradiction in the strong statement I have just made, as I am convinced that nearly all, if not quite all, of my brother Officers recognize the *immediate necessity* of adding an extensive number of machine shell-guns to the armament of the Navy, if only to keep us on *equal* terms with our neighbours. As it is of no use making strong statements unless something is proposed which may remedy the state of affairs to which attention has been called, I will now make some proposals, and give a reason for each proposition which I sincerely hope may be clear and acceptable.

A large quantity of machine-guns capable of throwing a 2-lb. shell should be *at once added to the armament of the Navy*. The number of 1-inch volley-firing Nordenfelt machine-guns should be increased to double the number (565) which we are to have by 31st March, 1884. I believe this latter proposition is going to be carried out as soon as the over-economical allowance to the Admiralty will admit of it; but this addition of 1-inch guns is not just now so all-important to the Fleet as the shell machine-gun, about which there is no suggestion to procure any for the Navy at this moment. The 2-lb. shell-gun should have the following qualifications: it should have great initial velocity and great penetration; the shell should be fused in the base and not in the head,

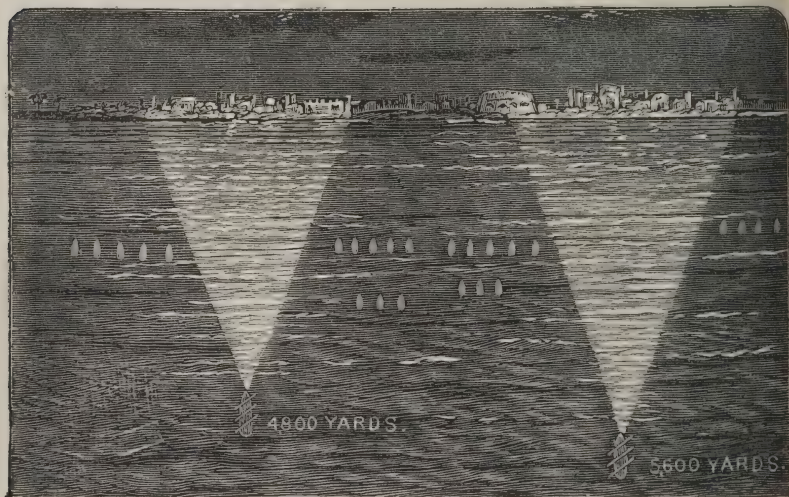
so as to leave the point of the shell clear for penetration ; the gun should be a single-barrelled gun, so as to be light and easily moved and shifted as wanted ; it should have as far as is possible an all-round fire, with perhaps an umbrella-shaped screen over the men, to keep bullets and shell-splinters clear of them, and from under which they can see the enemy from any point of the compass. Men that are hidden won't fight ; they must see what is going on to work well, and more particularly with these guns, if they are to be thoroughly effective. Lastly, it is imperative that the man who sights the gun should be able to fire it, as the eye and hand must work together : grouse would have a cheery time of it if they were attacked by two men, one to hold and lay the gun, and the other to pull the trigger. You want to keep hitting the enemy as rapidly as is possible, and therefore your gun should be mounted so as almost always to be able to bear. The advantages of this all-round fire are very apparent, whereas with a gun protected, it means a very cramped arc for training and a reduced possibility for the men to see what the enemy is doing. Nothing is more disheartening or demoralizing than being fired at without the chance of returning the fire. In support of the argument as to the advantages of an all-round fire, it may be mentioned that at Alexandria the "Téméraire" fired a great many more shots per heavy gun than any ship in the fleet, owing to her barbette principle. The French give it as their opinion, founded upon actual practice, that the proportion of hits between a barbette and a broadside ship, coming into range, passing at 60 yards, and going on out of range, is 3 to 1 in favour of the barbette. This is a subject for serious consideration in these days when one shot may win an action.

The reasons for advocating a 2-lb. shell-gun are : 1st, it is the best sized machine shell-gun, as it does not recoil even when on its landing carriage, and it has better penetration than the 2½-pr., and equally good penetration with the 4-pr. tried at Portsmouth, with lower initial velocity, both of which guns are considerably heavier ; 2nd, it is better than the 1-pr. because the 1-pr. common shell cannot penetrate unarmoured ships at 500 yards, or at any angle, nor can it penetrate a gun-port thicker than ½ inch, even at close range. The French, Danes, and others adopted the 1-pr. from economical reasons, because they thought that it would be a machine-gun that would answer *all* purposes, *i.e.*, repelling torpedo attack and firing into unarmoured vessels, and unarmoured parts and ports of armoured vessels ; and although it is a very useful gun indeed to them (particularly as we have not one of a similar nature to reply to it), still it has the fault of want of penetration at angles and certain distances ; and it is not as good as a volley gun for defence against torpedo-boat attack, as will afterwards be explained. The 2-pr. shell did penetrate at the Portsmouth trials 2½-inch iron at 300 yards range, and can therefore be relied upon to penetrate unarmoured vessels, gun-ports, &c., at any angle or range for which it is likely to be required. But whatever may be said against the 1-pr., the French adopted it in large numbers in 1875 as being the best shell machine-gun known at the time, and they are therefore dangerously ahead of us in offensive and defensive power at

this very moment. They are experimenting now on a gun throwing a heavier shell, and if satisfactory, will no doubt adopt it.

If the 2-pr. shell-gun is supplied at once to our Fleet, it will fill up a dangerous gap in our armament; it will give us a better gun than the French have of the same class, and the best gun possible in the important particulars of initial velocity, penetration, and accuracy, and above all in the immense advantages of simplicity of working and in its being far lighter in proportion to its utility than any shell-gun whatever. It will give us a gun by which we can always ascertain the range, both by day and night, than which nothing can be more important. It will give us a gun whose moral effect against men I have endeavoured to explain. It will also give us a gun which cannot be equalled in utility for arming small vessels and mercantile ships, as it can penetrate all unarmoured vessels and make itself considerably disagreeable inside. We have a 2-pr. gun at this moment in the country combining every one of the conditions named as necessary, which has been thoroughly tried and highly approved of, but as it COSTS MONEY we may be years before we get it.

Annexed is a sketch of the way in which the French fleet attacked Sfax, and which cannot but commend itself to our admiration. The large ships could not get in closer than is shown because of their draught. The boats were sent in at night, armed with the Hotchkiss 1-pr. shell-gun; they were perfectly hidden from view by the darkness caused by the counter-effect of the electric light, which was thrown upon the shore by the ships. They could also always shift their bearings and distance at any moment, so that only a chance shot could hit them; but they could always get their own range, because they saw where their own shells burst on shore. Sfax was taken and the forts silenced by the Hotchkiss 1-pr. shell-gun. We have no similar gun in the English Navy.



I will now turn to the question of the best gun for torpedo-boat attack, and give reasons why it is thought the best. I believe there is no gun at present invented which is better for repelling a torpedo-boat attack than the 1-inch Nordenfolt, of which we are to have 565 by the 31st March, 1884, but we ought to have, as said before, double that number.

The advantages of this gun consist in its simplicity of firing and working; in its throwing steel bullets, and in its firing volleys; also in the ease with which the same man who lays the gun by its sights can fire it the instant that they bear on the object. All these are most important points for repelling torpedo-boat attack. The action is simplicity itself; pushing the lever forward loads and fires, while pulling the lever withdraws the empty cylinders. A ship is an unsteady platform which a torpedo-boat would attack at great speed. For a shot to be effective and to stop the boat, the moment of getting the sights on *should and must be* the moment of firing. With this gun the man sighting it can fire at the moment. This is barely possible with a gun whose mechanism is worked by a revolving action, and he has the considerable advantage of firing a volley; the volley of steel bullets is better for stopping a torpedo-boat than a shell, as each bullet has, after penetration, greater wicked energy for mischief against the boiler and other vital parts than the fragments of a shell, and being fired in a volley there is more chance of one or more of the shots hitting than with shells which are fired singly.

The French have given orders to rapidly increase the complement of Hotchkiss shell-guns they possess, as they find they are not suitable against torpedo-boat attack unless used in large numbers, although they are at the same time trying heavier shell-guns of other patterns.

The foreign machine shell-guns are fired by a revolving key, which is a far more difficult principle for a man to work and fire instantly when his sights are momentarily on. Revolving machine-guns are excellent in their way, and we owe the father of them, Dr. Gatling, a great deal for his most valuable invention, but their principle invites an accident, they have to do five things nearly simultaneously, any one of which by going the least bit wrong interferes with the other four, and the gun is instantly out of action; the five things are:—revolving the lever, revolving the barrels, loading the gun, withdrawing the empty cylinders, firing the gun, all to be done nearly simultaneously. It is not my intention to enter into a criticism of the different mechanical inventions, but rather to point out, as I said at first, the class of machine-gun which we in the Navy think combines the greatest advantages with the fewest disadvantages.

We will now turn to the third class of machine-gun which is necessary for the Navy, the "Gardiner" and of which we are supposed to get 350 by 31st March, 1884, to add to the 142 Gatlings we have already in the Service.

All Officers of both Services are unanimous in their opinion that a rifle calibre machine-gun should throw the same ammunition as is used by the Infantry; this should be the first, foremost, and imperative consideration. Nearly all the foreign nations have avoided the

expense, and shirked the necessity for these guns by having magazine-rifles on board ship. We have, however, a number of rifle-calibre guns on the Gatling and Gardiner principle, of which the old pattern Gatling has been very serviceable to the Navy on many occasions, although, being an early invention, its mechanism has been far from perfect, and it has through this defect undoubtedly often failed. A new Gatling with the very best system of feeding has been invented (see Plate), and is believed to be perfect, but it must have the disadvantages that have been mentioned as being inseparable from the revolving system, and it cannot have the enormous advantage which lightness must be to a gun of this description. The rifle-calibre gun has many uses for the Naval Service. It is a manslaying gun, it is essential as an auxiliary for boat work, either attacking boats, boarding, or covering landing parties, and as an auxiliary field-gun for naval service. It further is useful in tops of ships, and commanding positions in vessels, where, from its comparative lightness, it can be easily shifted about, to search out ports and conning towers, &c. For clearing streets, holding positions, and the many varied and sudden duties the Naval Service have to perform on shore, it is unequalled in utility. In these days when ships are built with rams, and Captains may be tempted to use them, what a fearful weapon the rifle-calibre machine-gun would be to play upon the boarders, who as a necessity would be ready to board or repel boarding. It may be here remarked that it is not the number of shots that can be fired without aiming by a machine rifle-calibre gun that makes it so valuable, but *its power of being able to fire them on occasions when the sights are on, and also the tremendous reserve which they undoubtedly are.*

The practical value of machine-guns throwing bullets under certain conditions has been very well tested at Alexandria lately, most decidedly in their favour. Captain Walford, R.A., in an excellent and able paper read in the theatre of this Institution on Friday, February 16th, 1883, relative "to the effects of the bombardment of the Forts of Alexandria,"¹ appears to be mistaken or wrongly informed on this matter. Captain Walford remarks on the few hits apparent, and the total absence of bullets found about the ports and batteries, but he visited the scene some considerable time after the engagement, when marks may or may not have become obliterated, but when there was certainly no chance of picking up a bullet, after the crowds of soldiers, seamen, and Arabs had searched everywhere to find relics of the fight. I may, however, state, that when first sent to Mex, I picked up myself six Nordenfelt bullets all lying close together, and not far from the rear of one of the 10-inch guns, and I frequently saw my men with others they had picked up. I may also add that two Egyptian Officers, who were prisoners under my charge when Chief of the Police at Alexandria, told me, through an interpreter, that the Egyptian gunners would have laid their guns much better if it had not been for the moral effect produced by the continual hail of bullets going over their heads. One

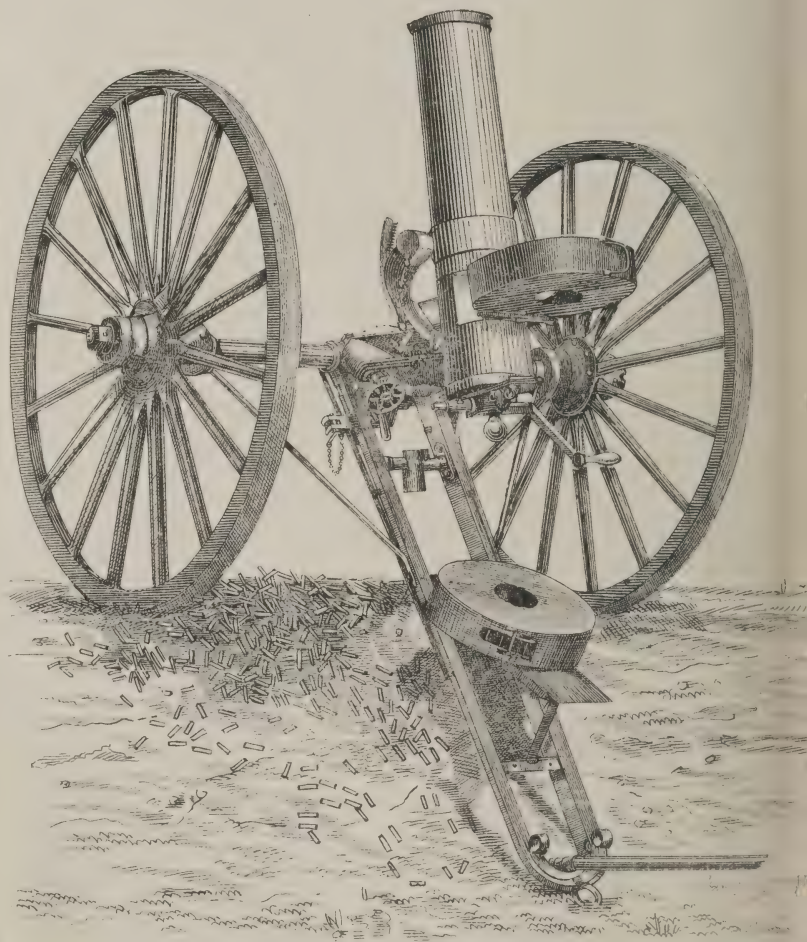
¹ Journal, vol. xxvii, No. CXIX.

GATLING GUN.

MUSKET CALIBRE.

Showing New Style of Feeding

Scale $\frac{1}{16}$.



of these Officers was on duty the whole time of the action in the Ras-el-tin Battery. The Gatlings were generally out of range during the action, so the only conclusion can be that the bullets mentioned were Nordenfelts. The Gatlings, however, came in very usefully for the landing, clearing the town of riot, and restoring order. It was openly stated by Arabi's Officers and men that nothing would induce them to face machines that "pumped lead," which referred to the Gatling, with which Captain Fisher held the lines with 370 men during four anxious days and nights. Such was the terror inspired by these guns when used for clearing the streets, that although there was an army of over 9,000 men within a short distance, they would not face the small party of 370 men, who held the lines with the Gatling guns.

Having now explained as well as I am able the use, advantages, and classes of machine-guns requisite for the Navy, the question will certainly be asked, why are three different classes wanted, as surely one would do? The conclusive answer to this must be, that the naval services are so varied, their system of attack and defence so different on different occasions, that it is impossible to have a single pattern gun and rifle, as it is to have a single pattern ship or boat. For brevity's sake the three classes of machine-gun may be called—

- | | |
|-----------------------------|-------------|
| A. The rifle-calibre gun— | Calibre .45 |
| B. The torpedo defence gun— | „ 1" |
| C. The shell and 2-pr. gun— | „ 1.5" |

Each of these guns should have their place in every man-of-war. We have got the A and B class in very small numbers, which may determine great things, particularly *in defence*, but we have not a single one of the C class or shell-gun, which would be invaluable *in attack*, and which I firmly believe would seal the fate of an action between two otherwise equally armed ships. To explain more fully my meaning, I have tabled three ships of the French, and three of the English fleets as they were at Alexandria. Taking "La Galissionnière" and "Invincible," the "Galissionnière" has, besides the advantage which ought to enable her easily to win) of having all her heavy guns breech-loading guns, and two heavy guns with an all-round fire, the enormous *extra* advantage of twelve 1-pr. Hotchkiss shell-guns (as he is at once to be given six more than she had at Alexandria). With these it is almost a certainty that she ought to win an action against the "Invincible," if they were engaged, although the "Invincible" is a larger, more costly, and heavier vessel in all respects than the "Galissionnière."

France.

'La Galissionnière'. . Barbette. 2 24-cm. guns B.L.R. (better gun than English 12-ton gun).
 Upper Deck. 6 14-cm. guns B.L.R., ditto.
 Main Deck. 4 24-cm. gun B.L.R.
 6 Hotchkiss¹ (to have 6 more immediately).

¹ Placed there before one Nordenfelt gun in the English fleet.

- "Alma" Barbette. 2 19-cm. guns B.L.R. (equal to our 6½-ton guns). Weight, 7¾ tons.
 Upper Deck. 4 14-cm. guns B.L.R.
 Main Deck. 4 20-cm. guns B.L.R.
 4 Hotchkiss¹ (to have 6 more).
- "Thétis"..... Barbette. 2 19-cm. guns.
 Upper Deck. 4 brass converted, about 16-pr. M.L.R. guns.
 Main Deck. 4 20-cm. guns.
 4 Hotchkiss¹ (to have 6 more).

English.

- "Monarch" In turrets. 4 25-ton M.L.R. guns.
 Under F.C. 2 12-ton M.L.R. guns.
 Main Deck. Stern fire. 1 6½-ton M.L.R. gun.
 7 Nordenfelts, and 1 Gatling.
- "Invincible" Upper Deck. 4 12-ton M.L.R. guns.
 4 6-in. M.L.R. guns, 64-prs.
 Main Deck. 6 12-ton M.L.R. guns.
 4 20-pr. Nordenfelts; 1 Gatling.
- "Alexandra"..... Upper Deck. 2 25-ton M.L.R.
 2 18-ton M.L.R.
 Main Deck. 8 18-ton M.L.R.
 6 20-pr. B.L.R. Armstrong.
 8 Nordenfelts.

This undoubted superiority, ship for ship, which the French Navy possesses at this moment means, that in a sudden war between England and France there is a chance of our being beaten. Why should there be such a chance (there ought to be none); and what does being beaten on the sea mean for England? It means certain, unavoidable, but disgraceful capitulation. It is of no use calling attention to the fact that all our riches, all our power, and nearly all our food are actually dependent upon the strength of our Fleet, and its readiness for immediate action. Every child knows that such is the case. If we are beaten at sea, we might have to pay four times as much as the French paid after 1871, this means about 800,000,000². If we are beaten at sea we have no other resource to turn to, and the victor can fix his terms to us or starve us. It is no question of years as it used to be, it is one of weeks, and as time rolls on, the capitulation would be made in days if we were beaten.

But the question will be asked—are all these horrors going to occur because England has not got a few hundreds of machine shell-guns? My answer is, that the machine shell-gun question is one of several all-important ones that want seeing to and settling immediately, if we, as seamen, are to be in the position the country gives us credit for—that of holding the undoubted supremacy of the sea. The shell-gun question is, however, the *only* one that can be settled

¹ Placed there before one Nordenfelt gun in the English fleet.

² Or the approximate amount of one year's imports and exports.

AT ONCE ; and, therefore, I have brought it forward illustrated by the actual facts contained in my statement. Time after time, in both Houses of Parliament, comparisons between our Fleet and other Fleets are deplored ; but why ? Are these regrets common sense ? How are the Armies upon which Continental countries rely for their existence regulated as to strength and readiness, but by comparison with each other, and if we wish to exist, we must compare our Fleets with those of other nations, and when we look carefully through these comparisons, there should not be discernible the very remotest chance of our being beaten at sea. The result of this comparison should be far different from what it is now, where even one nation has a chance against us, but where a combination of two or three would have a certainty of beating us.¹

Our *personnel* in the Navy is as good or better than ever it has been. I do not wish it to be understood that I think the Officers or men have deteriorated, but we should have to meet an enemy with a better weapon than we possess. I wish to have an equal chance with whomsoever we meet.

Another question will also be asked, and this probably by many,—if these things are as is stated, whose fault is it ? That is soon answered ; it is England's own fault, it is the country's fault, it is not a party question, as one party is just as bad as another. Don't suppose that all the facts glanced at in this paper are not thoroughly well known to every naval man and to all the Officers at the Admiralty, but what can they do ? The people in authority who know these facts are obliged, as a sort of matter of honour, to concur in what I may call the "Treasury policy for the hour," and that policy is always the same whatever party is in office. It is one of *misjudged economy* for the Services. The country always approves of this and won't allow money to be spent, and, therefore, what is to be done ? But if the time comes, which is by no means impossible, when we may be beaten at sea, don't upbraid and reproach the Navy or its representative authorities. We are not nearly in the position to do all that will be *confidently* expected of us in a sudden war with a European Power, and what war can be other than sudden now. Many grave and unlooked-for events must occur in these days of invention, on the sea, which will tax the energy and resources of the Navy to the utmost. We must be given the best ships, the best guns, and the best attention that money and foresight can buy or command to feel confident as to our ability to fulfil the many and sudden obligations which would certainly be thrown upon us in time of war.

Have we got, either in quality or quantity, what we should have, to fulfil these conditions ? No ! because it is a question of money. The money voted for the Naval Service is simply the insurance England pays for her wealth and prosperity. Taking year after year, is the increase in this insurance, as represented by the Naval Estimates, anything at all in proportion to the feverish increase of naval armaments abroad, or to the gigantic increase of our wealth and prosperity as represented by the tonnage of our Mercantile Marine and the value

¹ Give us an equal chance, and pluck will carry us through.

of exports and imports? for this increase of our Mercantile Marine adds more and more to the vital spots open to easy attack by an enemy, as the whole of it would be under the protection of the Navy in time of war. The annexed table clearly answers this question.

Navy Estimates.

1854-55.....	£7,487,948
1880-81.....	10,492,935

Value of Imports into and Exports from the United Kingdom in each of the Years 1854, 1860, 1870, and 1880, so far as the same can be given.

Years.	Imports.	Exports.		Total value of imports and exports.
		Of British produce.	Of Foreign and Colonial produce.	
	£	£	£	£
1854.....	152,389,053	97,184,726	18,636,366	268,210,145
1860.....	210,530,873	135,891,227	28,630,124	375,052,224
1870.....	303,257,493	199,586,822	44,493,755	547,338,070
1880.....	411,229,565	223,060,446	63,354,020	697,644,031

Total Tonnage of British and Foreign Vessels that Entered and Cleared in the Foreign Trade at Ports in the United Kingdom in each of the Years 1830, 1840, 1850, 1860, 1870, and 1880.

Years.	Entered.			Cleared.		
	British.	Foreign.	Total.	British.	Foreign.	Total.
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
1830	2,180,042	758,828	2,938,870	2,102,147	758,368	2,860,515
1840	3,197,501	1,460,294	4,657,795	3,292,984	1,488,888	4,781,872
1850	4,700,199	2,400,277	7,100,476	4,742,345	2,662,243	7,404,588
1860	6,889,009	5,283,776	12,172,785	7,025,914	5,490,593	12,516,507
1870	12,380,390	5,732,974	18,113,364	12,691,790	5,835,028	18,526,818
1880	20,490,512	8,583,043	29,073,555	20,858,472	8,804,036	29,662,508

The present Naval Estimates give us a Navy which is barely able to defend itself. What is to become of the 21,000,000 tons of British shipping which conveys our food and wealth, and is the mainstay of our prosperity, if a sudden war breaks out and the Fleet is worsted in even one action? The popular belief is that the mercantile steamers could take care of themselves, but that is only a supposition. The only possible manner in which they could take care of themselves would be in their ability to steam very fast in an opposite direction if they met

an enemy's cruiser. The guns proposed to arm these steamers with are obsolete and useless when compared with the armament that any foreign cruiser would possess. England possesses no stores of modern war *matériel*, and therefore at present cannot possibly place any armament in her great mercantile fleet, of either an offensive or defensive character, which could ensure in any way the safety of themselves or of the valuable cargoes they carry.

Annexed are tables showing the various machine-guns and their trials, weights, penetration, velocity, and description of projectiles; also a table showing the various machine-guns on trial by England and other nations; these tables are interesting and instructive, and show some very clear comparisons.

In the above remarks I hope it may not be thought that it is intended to throw blame upon the authorities and my superior Officers. I have simply stated actual facts with a view of strengthening the authorities' hands to ask for more money to put things right in the Navy.

Machine-Guns.

Navies of	In use and under delivery.	Under trial.
England	566 1-inch Nordenfelts. 3 Hotchkiss. No shell-gun of any kind.	2-pr. Nordenfelt shell-gun. 6-pr. shell-guns proposed by Armstrong & Co. Ditto Hotchkiss. Ditto Nordenfelt.
France.....	752 Navy } 303 War De- } Hotchkiss part. } shell-guns. No Nordenfelts.	3-pr. shell-guns proposed by Hotchkiss. Ditto Nordenfelt.
Germany	303 Hotchkiss shell-guns. No Nordenfelts.	Krupp's factory ordered to construct suitable heavier shell-gun.
Italy	42 1-pr. Hotchkiss shell- guns. 100 1-inch Nordenfelts.	2½-pr. Nordenfelt shell- gun.
Russia.....	106 1-pr. Hotchkiss shell- guns. 37 1-inch Nordenfelts (Palmerantz).	2-pr. Nordenfelt shell- gun. 2½-pr. Hotchkiss shell- gun. 1-inch Nordenfelt.
Austria	42 1-inch Nordenfelts. 16 2½-pr. Hotchkiss shell- guns.	2-pr. and 3-pr. Nordenfelt shell-guns.
Sweden	30 1-inch Nordenfelts. No Hotchkiss.	2-pr. Nordenfelt shell- gun. 2½-pr. Engstrom breech- loader.

Navies of	In use and under delivery.	Under trial.
Norway.....	6 1-pr. Hotchkiss shell-guns. 2 1-inch Nordenfelts.	
Denmark.....	67 1-pr. Hotchkiss shell-guns.	2½-pr. Hotchkiss. 2½-pr. Nordenfelt shell-guns.
Holland.....	121 Hotchkiss. No Nordenfelts.	
Spain.....	24 1-inch Nordenfelts. 1 Hotchkiss.	
Greece.....	42 1-pr. Hotchkiss. ? 1-inch Nordenfelt. ? 2-pr. Nordenfelt shell-guns.	
Turkey	150 1-inch Nordenfelts. 5 Hotchkiss.	2-pr. Nordenfelt shell-gun.
United States of America..	43 Hotchkiss. No Nordenfelts.	
Brazil	66 1-inch Nordenfelts. 6 2-pr. Nordenfelt shell-guns. 11 Hotchkiss.	
Argentine Republic.....	4 1-inch Nordenfelts. 11 Hotchkiss.	
China	24 1-inch Nordenfelts. 26 1-pr. Hotchkiss.	
Japan	14 1-inch Nordenfelts. 1 Hotchkiss.	
Chili	38 Hotchkiss.	
Portugal.....	3 Hotchkiss.	
Other small States.....	21 Hotchkiss.	

Rifle-Calibre Machine-Guns.

Gatlings.... 300 delivered to England, 500 to Russia, 600 to Turkey, and smaller numbers to other countries.

Gardiners... 350 ordered by England, none by any other country.

Nordenfelts.. 84 delivered to Sweden, 50 to Turkey, 40 to the Argentine Republic, 23 to Brazil, and smaller numbers to Roumania, Egypt, Spain, Portugal, Peru, Norway, the Cape, &c.

Memorandum of Particulars of new Gatling Gun and 6-pr. Rapid Fire Gun.

Gatling Gun.

Gun.....	230 lbs.
Gun-carriage.....	260 „
Gun-carriage ammunition boxes for 4 magazines with bullet-proof faces.....	65 „
Limber to hold 12 magazines and 10,000 rounds of ammunition.....	450 „
16 magazines (14 lbs. each).....	224 „
10,000 rounds of ammunition (120 lbs. per 1,000).....	1,200 „

6-pr. Gun. Armstrong.

Weight of gun.....	4 cwt.
„ projectile.....	6 lbs.
„ charge.....	2 „
Velocity of projectile.....	1,650 feet per second.
Calibre.....	2.25 inches.
Length of bore.....	67.5=30 calibres.
Bursting charge of common shell.....	12 $\frac{3}{4}$ ozs.
„ „ shrapnel „.....	$\frac{1}{2}$ oz.
Number of bullets in ditto.....	92

Comparative Weights.

A. Field Carriages.

Description.	9-pr. field gun.	13-pr. field gun.	Nordenfelt 5-barrel machine-gun mounted on its galloping carriage.	Service new 12-pr. B.L. Field Artillery mounting.
	cwt. qrs. lbs.	cwt. qrs. lbs.	cwt. qrs. lbs.	cwt. qrs. lbs.
Gun-carriage with gun mounted ...	19 0 12	20 0 0	8 3 4 including 12 hoppers	38 0 0
Limber packed....	16 0 4 including 36 rounds	17 3 0 including 36 rounds	8 3 20 including 5,000 rounds	With 2 gunners and kits on limber
Total weight.....	35 0 16	37 3 0	17 2 24	38 0 0

B. Naval Landing Carriages.

Description.	9-pr. M.L. gun.	12-pr. B.L. gun.	Gatling 0.45-inch gun.	Nordenfelt 5-barrel machine-gun.
	cwt. qrs. lbs.	cwt. qrs. lbs.	cwt. qrs. lbs.	cwt. qrs. lbs.
Gun.....	8 0 0	8 0 0	3 3 24	1 0 16
Gun-carriage and limber, packed....	16 0 25 including 24 rounds	19 1 25 including 24 rounds	13 1 9 including 1,500 rounds and drums	10 0 4 including 5,000 rounds and hoppers
Total.....	24 0 25	27 1 25	17 1 5	11 0 20
Number of crew.....	18 men	18 men	14 men	8 men

Hotchkiss Machine Shell-Guns.

Navies of	In use and under delivery.
England.....	3
France.....	752 Navy 303 War Department
Germany.....	303
Italy.....	42
Russia.....	106
Austria.....	16
Norway.....	6
Denmark.....	67
Holland.....	121
Spain.....	1
Greece.....	42
Turkey.....	5
United States of America.....	43
Brazil.....	11
Argentine Republic.....	11
China.....	26
Japan.....	1
Chili.....	38
Portugal.....	3
Other small States.....	21
Total.....	1,921 on May 1, 1883.

Gun.	Weight of gun.	Number of barrels.	Nature of fire.	Rapidity of fire.						Total number of pieces in the guns.	
				Time of firing 1,000 rounds.	Firing 3,000 rounds.		No. of rounds fired in 1 minute.	No. of rounds fired in 30 seconds.	No. of rounds per 10 lbs. of weight of gun.	Per barrel.	Total.
					Time of firing.	No. of reliefs of men.					
French Mitrailleuse	lbs. 690	25	Volley	' "	' "	....	180	100	1.4	....	....
Gatling (Service)	444	10	Single shots	....	....	....	400	220	4.9	....	....
Gardiner.....	280	5	Volley	1 35	6 20	Nine	650	336	11.7	23.4	117
Do.	101	2	Single shot	2 57	11 39	Five	400	236	23.3	33.0	66
Do.	56	1	"	5 40	....	....	200	120	21.4	....	....
Nordenfelt	230	10	Volley	0 59	3 3	None	1,017	510	22.1	10.8	108
Do.	120	5	"	1 41	5 47	None	600	360	30.0	16.0	80
Do.	56	3	"	2 40	10 30	None	400	220	39.2	11.7	35
Do.	36	2	"	3 9	....	....	320	180	50.0	14.5	29
Do.	13	1	Single shot	5 57	....	....	180	100	76.9	23.0	23

The Nordenfolt Volley-Firing Gun and the Hotchkiss Revolving Cannon firing Single Shells for Defence against Torpedo Boats.

Gun.	Calibre. ins.	No. of barrels.	Total weight of gun and mounting. cwt. qrs. lbs.	Weight.		Velocity.	Energy per sq. inch of sec- tional area of pro- jectile.	Rapidity of fire.						Penetration.		Portsmouth trials, 1880.					
				Powder charge. oz.	Projectile. oz.	Muzzle. f. s.	At 1,000 yds. range. f. s.	Muzzle. ft. tns.	At 1,000 yds. range. ft. tns.	Maximum. Aiming.	Maximum. Aiming.	Maximum. Aiming.	Maximum. Aiming.			No. of shots fired.	No. of hits made.	Time. ' "	No. of shots fired per minute.	No. of hits made per minute.	No. of rounds per hit.
Nordenfolt	1	4	*7 0 19	1·53	7½	1,500	806	9·1	2·6	40	20	100	60	200	120	932	359	22 20	41·7	16·07	2·59
Hotchkiss.	1·46	5	*5 0 2	2·9	18	1,400	834	9·4	3·3	10	3	30	8	60	14	334	136	23 14	14·3	5·85	2·4

* See Page 349, "Manual of Gunnery, 1880."

The Nordenfjeld and Hotchkiss Shell-Guns.

Gun.	Calibre.	Weight of gun.			No. of barrels.			Weight.		Chilled shell.		Common shell.		Velocity.		Energy per sq. inch of sectional area of projectile.		Rapidity of fire.		Penetration.		Energy at muzzle.	
								Powder charge.	Projectile.	Weight.	Bursting charge.	Weight.	Bursting charge.	Weight.	Bursting charge.	Muzzle.	At 1,000 yards range.	Maximum for one minute.	Aiming for 1 minute.	Distance.	Target.	Total.	Per 1 cwt. of weight of gun.
Nordenfjeld	1.5	2	2	0	1	8.5	1.75	1.75	lbs.	lbs.	grs.	lbs.	oz.	f. s.	f. s.	ft. tns.	ft. tns.	29	15	yds.	steel.	21	8.4
Hotchkiss.	1.85	11	3	7	5	7.05	2.5			2.5	667	2.5	1.5	1,394	902	12.04	5.0	40	19	300	1 $\frac{3}{8}$ "	12.04	1.2
"	2.09	21	2	17	5	12.7	4.0			4.0	1,122	4.0	2.6	1,345	954	14.5	7.3	40	10	300	1 $\frac{3}{4}$ "	14.5	0.7

The CHAIRMAN: The object of reading papers in this Institution is that they should be fully discussed. We shall now be happy to hear any observation that any person may wish to offer.

Vice-Admiral VESEY HAMILTON, C.B.: I wish to make a few remarks on the very instructive lecture to which we have just listened, and before doing so to thank the lecturer for giving us so much valuable information. The strong point that he has laid before us is the inferiority of our ships in point of armament to those of the French, and upon that point I think the gallant lecturer is a better authority than any one here, for very recently he has been employed in co-operation with the French Navy, and therefore he knows their qualities better than we do. On that point I accept his statements unreservedly, though I am very sorry to have to do so, but those who know Lord Charles Beresford know very well that he is not one of those who foul their own nest. Very lately we had a discussion in the House of Commons upon the Navy Estimates, which was opened by a noble lord, proving incontestably from statistics that the state of the Navy was very black indeed. He was followed by another member of the House, who by equally incontestable statistics proved that the Navy was all white. He was again followed by blacks, and so it went on alternately, blacks and whites. What the real truth is nobody knows, and the House of Commons, or those few who listened,¹ are perfectly satisfied that we should remain in that state. I am afraid statistics are something like the old saying of the foes of lawyers' agreements, that they lie first on one side and then on the other, and when they are dead they lie still, because anything can be proved or disproved by them. There was one very sensible suggestion made, and that was by the First Lord of the Admiralty, when he said it was necessary to have a Royal Commission to investigate the relations between the Admiralty and the Ordnance Department of the War Office. No doubt an increase of machine-guns is an actual necessity. The lecturer has pointed out the demoralizing effect of a rain of lead bullets. Now I cannot give a better illustration of the moral effect of having a good weapon in your hands than that afforded by the late disturbances in Ireland. In April, 1880, the first thing between Dublin and Queenstown that struck me was at every railway station a constable with his sword bayonet and rifle handy; and in all the riots that have occurred lately in that country, all the constables were armed with rifle, bayonet, and ammunition (of which we have all heard a good deal), buckshot. Now an Irish mob is not at all a pleasant mob to deal with when they think that you will put up with their gentle amenities; and there is nothing of which the British nation ought to be more proud than of the admirable manner in which the Irish Constabulary and the troops stood the showers of stones, mud, &c., and abuse, that they received,—as no other nation's armed force would have done. But when the Irish mob found that the troops were in earnest, and meant to use those weapons, there was no more of that sort of work. There is no doubt about it that the admirable manner with which those troops and police stood those attacks was owing to the knowledge that, when it came to the point, the weapons they possessed gave them an overwhelming superiority over the brute force of the Irish mob. I should like to know where the A, B, C, or D divisions of the English police would have been if they had been mixed up with an Irish mob, armed only with their batons. I am afraid but few would have been left. The gallant lecturer called attention to the manner in which the French were supplied with machine-guns long before we were. That, I think, is a most humiliating fact, that the English Navy, one of the largest in the world, should have to follow in the wake of a country whose secondary consideration will always be its Navy, and its first consideration its Army. The lecturer has pointed out that the Nordenfelt 1-inch gun is the best gun we possess against the attack of torpedo-boats. I am delighted to hear that, for the simple reason that the gun was introduced into the Service purely by the Navy against the strong opposition of the War Office, so strong that Mr. Ward Hunt at last took upon himself to order 100 Nordenfelts and the corresponding

¹ I have twice attended debates on Navy Estimates. During those eight hours there were at no time forty members present, and at one time only six.—V. H.

ammunition, a very extensive order it was, and a very great responsibility he took upon himself, about a quarter of a million, and we know the admirable results that have followed from that bold step, and we must all regret that he is not here to-day at this lecture. There is one curious fact; I should have liked to have remarked with regard to the names we have heard to-day, Nordenfelt, Hotchkiss, Gatling, and Gardiner, they are all foreigners. We naval men are deeply indebted to them for having given us weapons that enable us to repel the attacks of torpedoes. In fact, before that, we in the ironclads were very much in the position of the lion in the menagerie who in his old age was so worried and teased by rats that they did not know what to do for him. At last a little terrier was put into his cage. At first, the lion did not approve of this addition, but when he saw the little terrier kill the first rat, he took to him at once. Now Mr. Nordenfelt has given us the terrier to enable us to beat off the rats that will attack our ironclads. But I should be much better pleased if these men that we have heard of to-day were Englishmen, for I think there are Vavaseur and Whitworth, Armstrong, and a host of other English civil engineers who would have supplied us excellently well. There is one subject on which English politicians are particularly strong, and that is the subject of free trade, but the closest monopoly in the kingdom is the manufacture of guns. The British man-of-war is built entirely of contract materials except the very article which she is built to carry. A vessel costing half-million ought to carry the best guns that can be put into her. I am perfectly certain that if we were to throw open the competition in guns to all our eminent civil engineers they would do as our eminent engine-makers have done with regard to engines, give us the best in the world; and the Admiralty should have the power of purchasing the best weapon. The lecturer states that by the 31st March, 1884, the Navy will possess 565 Nordenfelt machine-guns of 1-inch calibre, throwing a solid steel bullet, and principally useful in repelling torpedo-boat attacks; added to this, on the same date the Navy will possess, or should possess if the contract is fulfilled, 350 Gardiner machine-guns, .45, or rifle, calibre, throwing lead bullets. Now I would suggest that he should add to that, that "the Navy will possess, or ought to possess," so many Nordenfelts, unless he goes upon some certain data of official utterances; official utterances in the days of "Sir Joseph Porter, K.C.B." were infallible, but I do not think naval men will say they are so now. The paper we have here is a Return laid before the House of Commons of the number of guns ordered for the Navy during the last three years and the number supplied. In the first year, that is 1880, there were thirty-two guns ordered: the number made was more; 11,000*l.* was taken in the Estimates for that; what has become of that I do not know. The next year 125 guns were ordered at the estimated cost of 74,000*l.*, 4 of those guns were made, but none delivered to the Navy.

The CHAIRMAN: Were they machine-guns?

Admiral HAMILTON: Guns of all sizes. Altogether in those three years 389 were ordered, and only 77 have been supplied to the Navy. I hope the gallant lecturer is going upon some certain data as to the number that we shall have. We ought to possess that number, but we ought to possess three times that number.

Captain P. H. COLOMB, R.N.: My only reason for speaking at all on this subject is that I happen to have had something of an official connection with it, having presided over the Machine-Gun Committee, which ultimately brought the Gardiner gun into the Service for some months. The lecturer has described some of the advantage of shell machine-gun fire, in most of which I thoroughly agree. There is, however, one point which, I think, he puts rather too strongly, and that is the advantage which shells would give us in finding the range. The shell would not give us the range unless it actually struck the ship, for I presume in all cases of machine-gun fire time-fuzes would not be used. I suppose that would be the case?

Lord CHARLES BERESFORD: A 2-lb. shell will burst on striking the water.

Captain P. H. COLOMB: I am very glad to have brought out that explanation, because it seemed to me to want it. Then, I think, we must keep in mind, in this question of range, that in the attack and defence of fleets the range is constantly altering, that we cannot expect to get many discharges from any machine-gun on board ship without re-laying between every round. I am not quite in

agreement with the lecturer on the subject of protecting the machine-guns. I do not think that protection necessarily limits the arc of training. I think protection can be devised which will leave the arc of training free or very nearly free, and I think that the advantage of protection in the face of machine-gun fire is so great that even some training might be given up, with advantage, to it. I am very strongly on the side of the lecturer when he says that the man who lays the gun should also fire it. Having fired a good many rounds myself I have felt that necessity strongly, and it has always struck me that if inventors would turn their attention to making use of the firer's foot as well as of his hand something in that way might be done. No arrangement of treadle has as yet been proposed that I know of, but it seems to me we may get the laying very conveniently arranged, and the firing done by the foot, which would be a movement entirely under the control of the person operating. I do not quite agree with the definition of machine-guns given by the lecturer. I think that any gun which gives you exceedingly quick firing should be called a machine-gun. The quick firing 6-pr., which we are to have, may be mounted on a central pivot in the same way as Mr. Vavasseur now mounts his gun, and will, I think, to all intents and purposes be a machine-gun; but there is this to be said, that the real advantage of the machine-gun consists more in the ammunition than in the gun itself, and if you fix upon the kind of ammunition you want to fire, you should be prepared to fire it from a great variety of machine-guns; that you may have one barrel, two, three, or ten, or twelve barrels, according to the nature of the work you propose to do, and that you need not restrict yourself to any particular pattern, so long as each pattern fires the same ammunition. In the Gardiner gun it is a defect that we still have to use a special ammunition, and although I thought we should be able to use the ordinary rifle ammunition, yet until the rifle ammunition is altered and made solid-drawn, the Gardiner gun must have ammunition of its own, which I consider a drawback. Of course I must corroborate, as every naval Officer cannot help doing, the latter part of the lecturer's statement.

Vice-Admiral BOYS: I rise from the same reason that my predecessor has risen, because it was my duty to succeed him in his position as Chairman of the Machine-Gun Committee. We must all feel obliged to our gallant lecturer for the subject he has brought before us, and the way he has treated it. He has continued his argument throughout very clearly. His main object is evidently to obtain for the Naval Service a shell-firing machine-gun. He has dealt with other machine-guns also, but in some of his details he must allow me to differ with him. I know what the Council of the Institution wish is, viz., to have discussions on the papers read, and I am sure the lecturer himself will not object to any fair criticism on what he has said. He says, "A machine-gun proper should have no recoil, and should also be heavy enough to resist any great vibration after being fired, so that the sighting cannot be affected by the discharge of the piece." That is undoubtedly what is required of a machine-gun, but practically it is an impossibility, as far as my experience goes. I have seen a great many machine-guns fired, and I always observed that the heavier they were the greater comparatively the shock of the discharge. Whenever a machine-gun is fired there is a vibration, if you fix the carriage ever so firmly,—a vibration sufficient to throw the projectiles off the spot which they are intended to hit after the first round, so that the gun requires constant re-laying. The lecturer has corrected a statement which is made here, that the English had no machine-guns at all until 1878. There were two descriptions in the Navy before that date, the 1-inch and the 45-inch Gatlings. Now I must follow Captain Colomb in his statement about the practicability of finding the exact range from the effect of shells bursting, and I put it in two ways; the first is, as I think was pointed out, there are no time-fuzes, so that shells only burst on impact, and a shell will burst on striking the water. I have seen several of these Hotchkiss shells fired; you do see them strike the water and you see the splash, but you do not see the bursting of the shell, and a few seconds afterwards amidst the spray you may see a little puff of smoke floating away, but that does not give you a definite point for getting the range. Then supposing this shell passes through an unarmoured ship, the effect of the impact of the projectile causing the bursting of the shell occurs inside the ship, and the consequence is you do not see the burst at all; you see no more than if it

ad been a solid bullet striking the ship. I do not think it can have any effect in discovering your range where two objects are moving rapidly, like torpedo-boats or ships passing each other. In fact the succession of firing is so rapid that it is most difficult to fix a continually altering range. This is not the time to discuss the question of muzzle- and breech-loading, but there is a fact connected with machine-guns, which is this, that with our muzzle-loading gun the gun recoils inside the port; the port is lowered, and you merely have a small aperture through the port or the rammer-head to go through. But with breech-loading guns they are always up, the ports are always open, and the consequence is the crew of a breech-loader are actually more exposed to the fire of machine-guns than the crews of muzzle-loaders. I am quite aware that the time of muzzle-loading guns is passed. In the future we may revert to them if our chemists will invent for us a description of powder that does not require a long cylinder in which to burn it in order to obtain high velocity, and thus avoid the complications incidental to breech-loading arrangements not required for short guns. There is another point in which Captain Colomb appears to agree with the lecturer, that is when he says, "It is imperative that the man who sights the gun should be able to fire it, as the eye and hand must work together." I differ from that, and I maintain that it is not an absolute necessity that the man who fires a machine-gun should lay it. I invite any one here to sit down behind the Nordenfelt gun and try it with one hand on the elevating wheel, the other on the directing wheel, and the eye on the sights; if he is well in accord with the man who works the firing lever, I say you will get better shooting by having two persons, one to point and the other to fire that gun, than by having only one to do both, and for this reason: that the man who points the gun has both his hands engaged. He has his eye steadily along the sights. The act of firing the gun is somewhat laborious; if you continue firing the Nordenfelt gun for a minute or two, you will find there is a considerable effort required, and every time you fire the gun you take your eye off the sights. The lecturer has made an apparently apt illustration as to grouse-shooting, and I quite agree that the grouse would have a cheery time of it if there were two men to attack them as described, but supposing if when you alone were shooting grouse, you had to take your hand off the trigger to stretch your arm out, to take your eyes off your sight, and bring them back every time you fired, then I think that the result would be different, and it would be more like the use of pointing and firing a machine-gun. There is another consideration with regard to machine-guns which must not be lost sight of, and that is the uncommon waste of ammunition involved and the necessity for carrying a larger quantity of ammunition for all descriptions of machine-guns, because the reserve supply of ammunition is a most important one. Now I would ask the lecturer why he happens to have selected these three ships, the "*Galissionière*," the "*Alma*," and the "*Thétis*"—I think the "*Alma*" and the "*Thétis*" are two very old ships, looked upon by some persons as obsolete—in making comparisons between the French and English fleets?

Lord CHARLES BERESFORD: It is because they were at Alexandria.

Admiral BOYS: The lecturer says here that it is almost a certainty that the "*Galissionière*" ought to win an action against the "*Invincible*," if they were engaged, although the "*Invincible*" is a larger, more costly, and heavier vessel in all respects. I must say I do not agree with him, and I think every one here would think that if the lecturer himself commanded the "*Invincible*," the "*Galissionière*" would have a very small chance indeed, in spite of a few additional machine-guns. I think we might throw the "*Alma*" into the bargain, and that he would give a good account of both of them. I quite agree in the necessity for more machine-guns. The Estimates are the bane of the efficiency of the Navy, and I am sure if we only had a few more gallant Officers like our lecturer, who have the knowledge of technical subjects like this before us, are able to put it together, and are bold enough to bring it forward at this Institution, the Council, the authorities, and all who heard them would derive much useful information and could benefit therefrom.¹

¹ The Chairman had to remind me that the time for discussion was drawing to a close, otherwise I should have remarked on the different methods of loading and

Brigadier-General REILLY, R.A. : I wish to say a few words, though perhaps not quite allied to the subject of the lecture. An Admiral of the Navy has made some very unjust and very unfounded attacks upon the War Office with regard to the supply of guns to the Navy. I can say this—that the War Department can have no fear about a Royal Commission. We should be very glad to have it if it is thought worth while and I think it will prove that in every way that can be, the Navy receives the greatest support in the manufacture of their guns and of their war *matériel*. Everything is done for them that is required. However, he says he does not believe people who are interested in maintaining the present state of things in the House of Commons, and therefore he will perhaps think I am interested as an official in keeping the present arrangement, and he will not give much credence to what I say but if that be the case, I will refer him to those whom he will believe, and I will refer him to the present Lords of the Admiralty, who will tell him that all the insinuations that he has made are unfounded. I rose to contradict these statements because my friend Lord Henry Lennox advised me to do so.¹

The CHAIRMAN : Do let us try to keep away from anything that savours of personality. The criticism was made on a Department, and you are very properly defending it.

Lord H. LENNOX : I assure you that there is nobody in this assembly who has less idea of addressing any remarks than I had when I came here to-day, but being so pointedly alluded to by my gallant friend, I am bound in honour to give him the flattest contradiction, and to say that with him I should welcome the appointment of the Royal Commission which was threatened by my right honourable friend Mr. Smith only premising that I myself had suggested that very course in a humble pamphlet which I published seven months previously. Therefore I entirely concur with Mr. Smith and with my gallant friend, and I hope that Royal Commission will issue. As regards what my honourable and gallant friend says, there is nothing like a friend who stabs you in the back immediately behind you, and certainly without any knowledge on my part. As regards the "Conqueror" guns, my statement was based upon the authoritative statement in Parliament of the honourable and gallant gentleman the Secretary of the Admiralty.

Admiral HAMILTON : I beg to say, in explanation, I was criticizing the Department, and I beg to apologize to any honourable member here present to whom I may have personally given offence.

The CHAIRMAN : I do hope and trust that we shall remember that we are discussing machine-guns. I am afraid that owing to the quotation of my friend Admiral Vesey Hamilton we have rather gone away from the subject. It is only natural that those who are interested in these matters personally should make their explanation, and having done so, I hope we shall now return to the machine-guns.

General REILLY : I only want to say one word with regard to that Return that was produced just now by Admiral Hamilton about the guns given to the Navy lately. It is perfectly capable of explanation. I recognized by the figures that it was the Report laid before Parliament, and signed by myself, and I am perfectly certain that the Royal Commission which the Admiral suggests will prove to him that the work has been very satisfactorily done. He says he does not know where the 12,000*l.* balance went. I can tell him that it went for the benefit of the Navy. I just want to say another word about these guns that we have lately been putting on board the ships in the Navy. It was stated in the House of Commons that the

firing machine-guns, viz., the reciprocating action of the lever and the revolving action of the crank. The lecturer evidently prefers the lever, although I would not condemn either system possessing other advantages, for this cause : after considerable experience, I prefer the revolving movement ; it is steadier, less laborious, and equally applicable to continuous or volley-firing. I should also have noticed the positive evidence given by the Egyptian Officers who were in the batteries during the late action as to the moral effect of the fire of the machine-guns of the fleet on the gunners at the guns, which is far more conclusive than any opinions that may have been formed by our own Officers.—H. B.

¹ Lord H. Lennox objected to this. I should perhaps have said, "instigated me to do so," or "dared me to do so."

"Conqueror" could not go to sea because her guns were not ready, and the noble lord in his remarks said he should believe in the breech-loading guns if he saw them. At the time that the "Conqueror" could not go to sea because her guns were not ready, where do you think they were? They were lying on the wharf at Chatham for her, and a letter had actually been written from the War Office to the Admiralty to say that the third gun was ready; in fact, it was blocking up the wharf at Woolwich, and it was desired that it might be taken away.

Rear-Admiral Sir MICHAEL CULME-SEYMOUR, Bart., C.B.: I have only risen once before in this Institution, and when I got outside a friend said to me, "I suppose you do not want to be employed, because if you did you would not make such a fool of yourself." Now, I think my friend was quite wrong. As I understand it, the Admiralty support this Institution, and if this Institution is to be of any use to the Admiralty it can only be so by gentlemen expressing their opinions here. The lecturer has started rather a new line, by not being at all afraid to state facts, and I think the lecture is of value very much with regard to the subject of the lecture, that is to say, with regard to machine-guns, but still more as drawing attention to one of the many points in which the Navy is starved. It is all a question, as he says, of money, and not party at all; it is exactly the same whether a Conservative or a Liberal is in office—the Treasury will only give a certain amount of money—that is what it comes to, and it is a question how you will spend it. The Conservatives spend it more in keeping every ship perfectly efficient, and the Liberals try to spend more money in getting more ships. I only rise to remark how little the attention the country pays to the wants of the Navy. When the Estimates are brought forward in the House, the House is emptied immediately, and I hope the gallant lecturer, who has very many friends, having brought forward the subject, will be the means of helping a little in getting more money for the Service.

Major ROGERS, S.O.P.: Lord Beresford has invited the opinions of military as well as naval Officers, and, although not an artillery Officer, I claim to have contributed as much or more to the literature of this subject than any man in or out of the kingdom. I wish, in passing, to ask a question with regard to the 2-pr. machine shell-gun, which the lecturer desires to be introduced into the Service—how is the loading process carried on? The definition of a machine-gun (as to which Captain Colomb seemed to express some doubt) is, I take it, that it is loaded automatically. In the lecture delivered by Captain Walford (to which allusion has been made) it was freely asserted that out of 16,233 rounds fired from the Nordenfelt and 7,100 from the Gatling, no trace of bullets, except five, could be found. Yet in the tables prepared by Captain Walford he shows that the ships of the in-shore squadron, consisting of the "Penelope," the "Invincible," and the "Monarch," were engaged with the forts at a distance of 1,500 yards only, which is certainly within the range of machine-guns. However, we may accept the evidence of the two Egyptian Officers as conclusive, that bullets from the machine-guns were flying over their heads. I should like Captain Walford to sit in a mantlet placed at 2,000 or even 2,500 yards from the firing point, and to note the descent of the bullets from the Gatlings almost perpendicularly, and with a penetrative force equal to 5 or 6 inches of timber. This high-angle fire (of which the Gatling before us is capable) will, I think, form a great feature in the future of machine-guns. By it you can, by using 27 degrees of elevation, drop bullets into entrenchments at the rate of 1,400 rounds a minute. At closer quarters the angle of elevation must be increased. At 200 yards, for instance, 84 degrees are requisite. Tables have been prepared from actual experiment to establish these facts. The lecturer takes exception to the principle of the revolving system, and, although an old upholder of the Gatling, I am free to confess that the gun before us is as superior to the naval Gatling as the Martini-Henry is to "Brown Bess." However, we do not in this theatre desire to enter into the relative merits of these guns, so much as to sift the general question to the bottom. The world is wide enough and bellicose enough to reward each inventor in turn. The object of these discussions is, in fact, to stimulate the energies of inventors, and no doubt machine-guns will be perfected in time, but the real question is, What are we going to do with them? Sir, I am at a loss to conceive why it is that, after a dozen years of discus-

sion, the status of machine-guns in warfare is still problematical. Many of the suggestions made by Sir E. Hamley in a discussion on Mr. Gardner's lecture on this subject might, I think, have been practically illustrated during the late Egyptian campaign. First comes his question as to what might be expected from machine-guns in warfare with a nation ill-supplied with artillery or incompetent to use it. Secondly, what would be their use in bush-warfare in searching out a concealed enemy, of whose locality we had some idea. Thirdly, for home defence, might not machine-guns be employed at certain points for the protection of the lines of communication, where they would be of special service? And fourthly, would they not be useful during an insurrection for street combats? In America, during some disgraceful riots, the Gatling acquired the name of the "street-sweeper." General Hamley dwelt also upon the general usefulness of machine-guns, with cavalry as opposed to cavalry, with the same occasion, gave his artillery, for its protection. Lord Chelmsford, on the other hand, the Naval Brigade at experience by saying that the Gatlings did good service with a future before them, the battle of Ginghilovo, and he added that machine-guns *had* a future before them, not as employed with artillery but with infantry. And, Sir, I hope the day is not far distant when every infantry regiment will be supplied with a machine-gun to intensify its fire-action on occasion. The prejudice against machine-guns seems to be passing away, and I feel confident that the able lecture to which we have just listened will tend to confirm opinions in their favour, and perhaps to convert the stiff-necked. When we hear of such phrases as "of inestimable value," "unparalleled in utility," "of incalculable effect," applied to the action of these weapons, the age men as I have mentioned; when we hear the most successful soldier of the machine express his conviction that the General who in the next big war utilizes machine-guns to the best advantage will have an immense opportunity, we may rest satisfied that England will not be behind other nations in providing the most effective machine-guns both for our naval service and for our armies in the field.

Mr. J. BEVERLEY FENBY: I wish to be allowed to speak upon one or two engineering questions. With regard to sighting a gun in any way for a shifting range. The difficulties are very great, whatever system of sighting you may adopt, because, if you are firing at 1,000 yards range, and the sights are 36 inches apart, a very small deflection— $\frac{1}{100}$ th of an inch—would throw the bullet an inch out of range for every 100 yards of the distance; and we all know that aligning the sights to $\frac{1}{100}$ th of an inch is a sufficiently fine job when you are firing at a fixed object with an ordinary rifle. With regard to the question of vibration. The vibration of these machine-guns would always make the fire to some extent scattering; for I have found that a rifleman who is a good shot will make a better diagram on a target from 600 to 1,000 yards than you can possibly make with a machine-rest. The reason is shown by an experiment which I tried. I put an ordinary Snider barrel into a vice, and just held it tight, so that you could not easily move it with your hand. If you tap the barrel with a small mallet you will find that it vibrates; but no tapping of the barrel will make a rifle vibrate when a man holds it in the knee position, much less when he is lying down in the back position; because you could not make a tuning-fork vibrate if you held it between cork or india-rubber. A man's hand and shoulder are elastic; and remarkable as it may seem to those who have not tried it, I know as a fact that a good rifleman, who would have a good chance at Wimbledon, would beat any machine-rest in the world for firing with an ordinary soldier's rifle. With regard to ammunition. The gallant lecturer spoke about a one-barrelled gun. Now I am afraid a one-barrelled gun would get hot so rapidly that, except for about one minute's work, it could not be used at all. My experience is so with the Snider and the Martini. And there is another question with regard to the number of barrels in a gun closely connected with the question of the ammunition that you use. If you use the Service ammunition—the .450 calibre used in the Martini—I quite agree with the speaker who said it would be impossible to use the Martini Service ammunition in machine-guns with success, unless the Government adopt the solid-drawn brass case; for while they make the coiled brass case and attached head, the mouth of the cartridge will be sure to ruck up against the edge of the barrel before you have fired many rounds, and then you come to a dead stop, perhaps at the most critical moment of an action; but even if you have

a solid-drawn brass case I do not think you will find that, especially with a single-barrelled gun, you could go on with rapid firing for long at a time, more particularly with a light gun. I am afraid you could not fire any considerable number of rounds without wiping the barrel out. The barrel would get very hot, and leading would ensue; and there would be little or no lubrication to lessen the evil. In the ammunition which is now prepared for the Hotchkiss and Nordenfelt guns the projectiles are coated with brass or copper to avoid the leading or wearing of the barrel.

LORD CHARLES BERESFORD: Allow me to reply shortly to one or two remarks that have been made. Admiral Hamilton expressed a wish that Englishmen should come forward and make a machine-gun to compete with those guns that are manufactured by people who are not English. Well, they have tried at Elswick, and more or less satisfactorily, but they have not got so good a gun as that made by either Mr. Hotchkiss or by Mr. Nordenfelt. As to a 2-pr. having a recoil, a 2-pr. has no recoil, even when placed upon its field carriage. A 3-pr. or a 6-pr. can easily be made without recoil, but the weight must be added to considerably to get such a result, and weight is a most important matter on board ship. As to finding the range; the French consider their 1-pr. Hotchkiss more useful in that one particular than any other. As to the advantage of breech-loading heavy guns always being in the port when the guns are being loaded against the muzzle-loader which has to be run in to be loaded, and the port lowered; the breech-loader will certainly take and deflect most of the machine-gun bullets fired at the port, whereas with the muzzle-loader the bullets would probably either enter the port or break it up if it were lowered. The question of having one or two men to work a Nordenfelt is one very much open to argument. I only gave my opinion, and I invite others to do the same. As to the question of ammunition for machine-guns; the great point with these machine-guns is not their being able to expend an enormous amount of ammunition, but their capability of being able to pour a terrible fire, if only for a few seconds, upon any given object, when their sights are on. I have been asked why I compared "La Galissionnière," the "Alma," and the "Thétis" with the English ships; I did that because these were the ships that were alongside the English ships in Egypt lately. What Admiral Boys said rather strengthened my argument. The "Alma," "Thétis," and "La Galissionnière," certainly are very old types of ships; but I say that the French ships named were almost made equal to our ships, (which were better), at Alexandria, on account of the machine-gun shell-fire which the French had, and to which the English have nothing to reply with. With regard to Captain Walford's statistics as to the Nordenfelt's hits and bullets picked up, I think we shall all allow that he arrived too late to know exactly where the marks were and what really occurred, but certainly too late to pick up any bullets. As to the one-barrelled *shell-gun*, I prefer the one-barrelled gun as a *shell-gun* because it is so light compared to the revolving Hotchkiss *shell-gun* with several barrels, but I prefer a three or five *rifle-calibre* gun to a one-barrelled *rifle-calibre* gun. The *rifle-calibre* gun which I have asked Mr. Nordenfelt to mount for me on my galloping carriage is a five-barrelled gun, and the advantage of this over a single-barrelled *rifle-calibre* gun is that if four of the barrels are put out of action by any untoward event, you can still go on pumping lead out of the remaining one: whereas with the one-barrelled gun, or a gun which is fired and worked by rotary motion, if anything at all goes out of order, you are out of action and you must cease firing. What the last speaker mentioned about vibration is perfectly true, but it is exactly what is wanted in a machine-gun. Even a volley gives enough vibration to form a scattering action of the bullets, which for repelling a torpedo-boat attack is most valuable. With a shell there is only the single shot to rely on; a volley gun with its vibration is certainly preferable.

THE CHAIRMAN: I am sorry the meeting has rather diminished, but I am sure even those who have gone away, and certainly all here present, will unite in giving me directions to thank our lecturer most cordially for his lecture. It is not merely that he has taken great pains to bring before us a very important subject, and that he has evidently also taken great pains to procure these guns and diagrams, but he has also in his paper spoken out in a manly and straightforward manner. It is the great object of this Institution—I am sure I am speaking the sentiments

of my colleagues on the Council—that subjects of this nature should be brought forward in the manner they have been brought forward by the lecturer, and thoroughly and freely discussed without any allusion to personalities or politics. These are the objects we have in view in keeping this lecture theatre open (indifferent as its accommodation may be), that subjects of this great importance, either naval or military, should be thoroughly and freely discussed. I will now close the meeting by returning to Lord Charles Beresford our very cordial thanks for bringing before us in so able a manner such an important question.

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OCCASIONAL PAPERS.

This portion of the Number is reserved for Articles, either Original or Compiled, on Professional Subjects connected with Foreign Naval and Military matters; also for Notices of Professional Books, either Foreign or English.

It is requested that communications or books for review may be addressed to Colonel Lonsdale Hale, at the Royal United Service Institution, Whitehall Yard, London, S.W.

THE RUSSIAN ARMY IN 1882.

(Continued from No. CXX.)

By Colonel SIE LUMLEY GRAHAM, Bart.

PART III.

(*Conclusion.*)

The Reserve.

THE Russian soldier, as we have already explained, after completing his service with the colours passes into the reserve, in which he, as a general rule, remains nine years, during which time he is considered to be on permanent furlough, is under civil law, and may pursue any occupation. His family is assisted by the municipal authorities if he is called out to join the army in the field. He is liable to be called out twice for training during his reserve service, each time for a period not exceeding six weeks.

The reserve is divided into three classes; the first consists of soldiers who have not completed eight years of total service, and furnishes on mobilization the men required to raise the standing army to its war establishment. The second class consists of soldiers between eight and twelve years' total service, and feeds the *depôt* battalions which are formed on mobilization and from which losses in the field are made good. The third class, composed of men between twelve and fifteen years' service, forms on mobilization separate reserve units—infantry, field artillery, and engineers, for which the cadres exist in peace-time. There are at present no cadres for reserve cavalry or horse artillery, but the question of their formation is under consideration.

Before the last organic changes there existed eighty-two reserve battalions, each of which contained the cadres for the *depôt* battalions of two infantry regiments, into which they expanded on mobilization, having during peace-time been employed in garrison and escort duties; but at the termination of the last Russo-Turkish War the various new reserve units above alluded to were organized, and these we now proceed to describe.

The Reserve Cadres Infantry Battalions.

These are 97 in number (1 of the Guard and 96 of the Line). Each battalion consists of five companies, each of which is the nucleus of a battalion, to be completed on mobilization to the strength of about 1,000 men. Battalions thus formed will consist of four companies and will be grouped by fours into reserve regiments, which will take up their numbering in succession to the field infantry regiments from 165 to 260. The fifth company of each reserve

cadre battalion will develop into the dépôt battalion of the regiment formed out of its sister companies, being besides available for garrison duties. Four of these reserve regiments will form in time of war a reserve infantry Division, of which there will be twenty-four, numbered from 42 to 65. To each of these reserve Divisions will be attached one of the reserve artillery brigades which will be hereafter described, the body of troops thus organized being sent to one of the field armies or employed to guard the frontier or to garrison a fortress, according to circumstances.

Reserve Divisions may also be grouped into army corps. The reserve cadres battalions are equipped, trained, and organized in the same manner as battalions of the field army, take part in the annual manœuvres, and are rather inclined to consider themselves picked troops, but some of the conditions of their service are calculated to impair their military efficiency, as they are broken up into detachments sometimes spread over a considerable area, and are called upon to perform the duties which formerly devolved upon the local corps, most of which have been disbanded. This arrangement places them in a sort of nondescript position, the greater part of their time being devoted to garrison, escort, and transport duties, in the performance of which they are under the local military authorities, that is to say, the district military commandants, whilst their own commanding Officers are responsible only for their tactical training, being expected to visit and inspect their outlying detachments four times a year. In case of war these detachments will assemble at the battalion headquarters, where they will be completed to the full strength, instructions for carrying out which measure will be given in good time by the "General-Governors." The greater part of the reserve troops are quartered in the districts nearest to the probable seat of war (the western and south-western districts) (*vide* table accompanying map), and would furnish in case of need an important reinforcement to the field armies. Reserve troops sent to the front will be replaced by temporary levies raised by the local authorities, which levies will be equipped from the magazines of the disbanded local corps, but no Officers have as yet been told off for them.

On mobilization the reserve infantry available will be as follows:—

24 Reserve Divisions, each of—

	Battalions.
16 battalions	384
5 Guard battalions	5
96 Line Reserve dépôt battalions	96
	485

The establishments of reserve infantry units are as follows:—

	Officers.	Classed Officials.	Non-commissioned officers.	Drummers, &c.	Lance-corporals and privates.	Total combatants.	Non-combatants.	Grand total.
Peace—								
Reserve cadre battalions.....	29	3	35	11	445	523	31	554
War—								
Reserve infantry regiment	63	7	320	34	3,472	3,896	116	4,012
„ dépôt battalion	16	2	80	9	868	975	23	998

Reserve Field Artillery.

In peace there are six reserve artillery brigades of six batteries each. A reserve battery has four guns horsed in peace and eight in war. One battery of each brigade has 4·2-in. guns, three batteries have 3·42-in. guns, identical with the heavy and light field guns of the field artillery. The remaining two are temporarily armed with bronze guns, 9-prs. and 4-prs., but will eventually receive steel guns like those of the ordinary field batteries.

On mobilization each division will be expanded into a battery, and thus the 36 reserve artillery batteries represent 144 batteries on the war footing. 96 of these batteries are formed into 24 reserve brigades of one heavy battery and three light batteries, these brigades being numbered from 42 to 65, corresponding to the numbers of the reserve infantry Divisions.

The remaining 48 batteries form 6 depôt brigades.

Establishment of Reserve Artillery Units in Peace and War.

	Officers.	Classed officials.	Non-commissioned officers.	Trumpeters.	Rank and file.	Total combatants.	Non-combatants.	Grand total.	Horses.
Peace.									
Staff of reserves—									
Artillery brigade	3	4	..	1	..	8	15	23	1
Heavy battery	11	..	16	3	165	195	21	216	55
Light „	11	..	16	3	145	175	21	196	46
War.									
Staff of reserves—									
Artillery brigade	3	4	..	1	..	8	17	25	1
Heavy battery	6	..	20	3	195	224	13	237	178
Light „	6	..	20	3	162	191	13	204	151

The carriages of a reserve battery are as follows :—

	Heavy.		Light.	
	Peace.	War.	Peace.	War.
Gun-carriages	4	8	4	8
Spare „ .....	..	1	..	1
Ammunition wagons .....	..	12	..	8
Store wagons .....	..	3	..	3

The train of a reserve battery is the same as that of a field battery.

The reserve artillery brigades are to be stationed at the following places in peace-time :—

Muraviev, Düna burg, Smolensk, Kursk, Taganrog, and Serpukhow.

Every reserve battery maintained during peace is to be provided with the complete *matériel* for the reserve or depôt batteries, which are to be formed

from it on mobilization. The men will be furnished by the Third Class of the Reserve.

Reserve Engineers.

On mobilization, one company is taken from each of the sapper battalions of the field army, either to be expanded into two reserve sapper companies or as the nucleus of a dépôt sapper battalion.

The thirty-four reserve companies thus formed are intended for service in the fortresses or on the line of communication, and to strengthen the engineer troops employed in sieges. All *matériel* required for the reserve sapper companies will be maintained in time of peace by the field battalions. The train of the reserve sapper company is the same as that of a field company.

Establishment of a Reserve Sapper Company in War.

				<i>Horses.</i>		<i>Carriages.</i>	
Officers	...	...	4	Saddle	... 1	Two-horse	... 2
Non-commissioned officers	...	...	20	Draught	... 16	Four-horse	... 3
Drummers	...	...	2		—		—
Lance-corporals and privates	...	...	215	Total	... 17	Total	... 5
Total combatants	...	...	241				
Non-combatants	...	...	6				
Grand total	...	...	247				

The total reserve engineer force organized on mobilization will thus amount to about as follows :—

Combatants	...	8,194	Horses	... 578	Carriages	... 170
Non-combatants	...	204				
Grand total	...	8,398				

Summary of the Reserve Formations.

The reserve forces are approximately as follows, including non-combatants :—

In peace :—

97 battalions of infantry (554)	...	...	...	53,738
6 brigades of artillery (1,239)	...	...	...	7,434
				61,172

In war :—

96 reserve infantry regiments (4,012)	...	...	...	385,152
101 reserve dépôt battalions (998)	...	...	...	100,798
24 brigades of reserve artillery (907)	...	...	...	21,768
34 reserve sapper companies (247)	...	...	...	8,398
				516,116

The number of reserve men required on mobilization to complete the reserve formations will thus be—

For Infantry	....	....	....	....	....	....	422,212
Artillery	....	....	....	....	....	....	14,334
Engineers (in addition to the peace strength of the field companies which serve as nuclei)	....	....	....	....	....	....	5,338
							<hr/> 451,884 ✓

The third class from which the men for these reserve formations would be drawn is at present calculated at a strength of 588,600, after deducting 10 per cent. for deaths, &c., so that there appears to be a sufficient margin unless anything like a general mobilization of the field army were required, when it would have to draw largely upon the third class of the reserve for some years to come, as the reserve of all classes on the 1st January, 1881, only amounted to 1,009,032, and as about 1,410,000 men are required to make up the field troops alone to their war establishment. In 1889, however, when the army organization should attain its full development, it is calculated that the total force of the reserve will reach 1,879,000, which will probably suffice even for the wants of the Russian Empire.

Depôt Troops.

Depôt troops are maintained for the purpose of keeping the field army up to its strength after mobilization, and are composed of men taken from the second class of the reserve. Cadres are maintained in time of peace for the depôts of all arms, except the engineers, each unit having at all times a permanent establishment of instructors, and in war-time a variable establishment of recruits.

Infantry Depôts.

164 cadres are maintained in peace-time for the formation of depôts for the line infantry regiments on the outbreak of war. Of these, 58, being local corps which escaped disbandment when the new organization came into force, are independent units which perform local duties, and 106 are small cadres composed of men selected from the disbanded local corps attached to the Staff of the District Commandants. It is part of the duty of these Officers to organize the depôt battalions of the field regiments belonging to their districts, at the headquarters where the stores and armouries of these battalions are placed. In case of mobilization the field regiments will detail a proportion of Officers and non-commissioned officers to the depôt battalions, which will then be filled up as quickly as possible with reserve men, and kept up if necessary by fresh drafts of recruits.

Depôt battalions are, as a rule, stationed in the recruiting districts of the regiments to which they belong, but this does not apply to Poland and the Baltic provinces, there being no depôts in those regions, the reserve men from which are distributed over the whole Empire.

The Guard regiments and other corps which have no special recruiting districts detach small cadres on mobilization as nuclei for their depôt battalions.

There will be in war-time—

12	Guard depôt battalions.
16	Grenadier depôt battalions.
7	rifle " "
164	line " "

199 depôt battalions.

Each battalion will have 4 companies except the Guard rifle battalion, which will only have 3 companies.

The 58 independent cadres have peace establishments varying from 1 Officer and 71 non-commissioned officers and men to 1 Officer and 178 non-commissioned officers and men, according to local requirements for the special duties performed in peace-time. Finland line rifle battalions have each a small cadre of 28 of all ranks.

Establishment of Dépôt Battalions.

	Combatants.					Non-combatants.		Grand total.
	Officers.	Non-commissioned officers.	Drummers and buglers.	Rank and file.	Total.	Classed officials.	Others.	
Cadre (permanent) in peace-time.....	1	5	..	20	26	..	..	26
Dépôt battalions—								
Permanent.....	13	40	4	64	121	2	28	151
Variable (maximum).....	16	60	20	900	996	..	..	996
Dépôt battalion of Guard Rifles.....								
Permanent.....	11	30	6	48	95	2	24	121
Variable.....	12	60	15	675	762	..	..	762

Cavalry Dépôts.

Each cavalry regiment has a dépôt squadron to break the remounts. It is often stationed far away from its regiment, with which it has no connection except with reference to the remounts. For instance, most of the dépôt squadrons are quartered in the Kharkov district, while the great bulk of the cavalry is on the western frontier.

The dépôt squadrons of the Guard cavalry and of the Dragoons of the Caucasus are, during peace, incorporated with their regiments, but on mobilization the ten dépôt squadrons of the Guard are formed into one brigade.

The dépôt squadrons of the six line cavalry regiments of every two consecutive cavalry Divisions constitute a dépôt cavalry brigade, which is under the immediate command of the military district authorities. In war-time, reserve men and recruits for the field regiments are armed, mounted, and, if necessary, trained at the dépôts, whence they are forwarded to their corps. For this purpose each dépôt squadron forms two provisional squadrons, which may also take the field as separate formations.

Staff of a Dépôt Brigade.

Commandant (Major-General or Lieut.-General)	1
Chief of the Staff	1
Officers on remount duty, including 1 field Officer....	6
Surgeons and V.S.	6
Armourer	1
Clerks	6
All ranks	21

Other Cavalry Depôt Establishments.

	Combatants.					Non-combatants.	Horses.
	Officers.	Non-commissioned officers.	Trumpeters.	Rank and file.	Total.		
Depôt squadron—							
In peace { Permanent	7	26	4	100	137	48	124
{ Variable .....	..	..	..	30	30		
{ On remount duty .....	..	3	..	32	35	2	
Additional, variable in war .....	..	..	..	80	80		
Provisional squadron	3	28	8	220	259	12	180
Caucasus Dragoon depôt squadrons (extra)	4	..	..	..	4	16	

In a Guard depôt squadron there are two additional Officers on remount duty and their three servants. There are thirty-nine privates on remount duty in a Guard depôt squadron.

Field Artillery Depôts.

The fifth and sixth batteries of the six reserve artillery brigades maintained during peace are formed, on mobilization, into six depôt brigades of field artillery, each of which consists of eight batteries. These forty-eight batteries correspond to the forty-eight artillery brigades in Europe and the Caucasus. The first four batteries in each brigade are armed with 9-prs., the remaining four with 4-prs.

Establishment of Field Artillery Depôts.

	Combatants.					Non-combatants.		Horses.
	Officers.	Non-commissioned officers.	Trumpeters.	Rank and file.	Total.	Classed officials.	Others.	
Staff of a depôt brigade	3	..	1	..	4	4	17	1
Battery of 9-prs. or 4-prs.—								
Permanent	6	20	3	74	103	..	18	39
Variable establishment	4		500	..	504	..	..	4

Horse Artillery Depôts.

There are three depôt batteries in peace-time, the third of which is at the

same time an instruction battery. These batteries are not used as cadres for new formations, but are raised to a war-strength on mobilization. For the first and second batteries only 2 guns and 1 ammunition wagon are horsed in peace-time; but in time of war 6 guns, 9 wagons, 1 store wagon, and 1 spare gun-carriage are horsed.

Establishment of a Dépôt Battery.

	Combatants.					Non-combatants.		Horses.
	Officers.	Non-commissioned officers.	Trumpeters.	Rank and file.	Total.	Classed officials.	Others.	
Peace establishment.....	5	13	3	157	178	3	17	51
War establishment—								
Permanent.....	5	13	3	157	178	3	20	135
Variable.....	3		500		503	..	..	3

Engineer Depôts.

On mobilization, four battalions of sappers of the line each detach a company to serve as nucleus for a dépôt battalion consisting of four companies.

Establishment of a Sapper Dépôt Battalion.

	Officers.	Non-commissioned officers.	Drummers and buglers.	Rank and file.	Combatants.	Classed officials.	Clerks of trains.	Grand total.
Permanent	13	40	4	120	177	3	24	204
Variable	11	40	6	740	797	..	8	805
Total.....	24	80	10	860	974	3	32	1,009

Summary of the Dépôt Troops, including Non-combatants.

In peace :—

	(Averaging)			
58 independent dépôt battalions	(125)	....	7,250
106 infantry dépôt cadres	(26)	....	2,756
56 dépôt squadrons	(252)	....	14,112
3 horse artillery dépôt batteries	(198)	....	594
Total	24,712

In war :—

198 depôt infantry battalions	....	....	(1,167)	....	231,066
1 Guard rifle depôt battalion	....	....	(883)	....	883
56 depôt squadrons	....	....	(332)	....	18,592
112 provisional squadrons	....	....	(271)	....	30,352
48 field depôt batteries	....	....	(625)	....	30,000
3 horse artillery depôt batteries	....	....	(704)	....	2,112
4 sapper depôt battalions	....	....	(1,009)	....	4,036

317,041

Supposing all these establishments were completed to this, their maximum strength on mobilization, the following numbers of reserve men would be required for the different arms :—

Infantry	....	....	....	....	221,943
Cavalry	....	....	....	....	34,832
Artillery	....	....	....	....	29,118
Engineers	....	....	....	....	3,326

289,219

Fortress and Local Troops.

These consist of infantry and artillery. Under the old system, the infantry local corps were very numerous, of various strengths, from that of a battalion downwards, and scattered over the whole Empire. There were 468 of these units in European Russia alone. These corps were recruited in the same manner as regiments of the field army, their men passing on to the reserve in due time. During peace they were used principally for garrison and escort duty, being under the local military authorities. In time of war they were completed to the war establishments, and served to maintain order at home in the absence of the field army. By the Decree of August 30, 1881, 363 of these units were disbanded, their places being taken, as already shown, by the reserve cadres infantry battalions. There still exists, however, a regiment of fortress infantry at Alexandropol in the Caucasus (if not already removed to Kars). This regiment consists of 1 battalion, in peace, with 852 of all ranks; of 3 battalions, in war, each of 1,080. Total 3,240. There are, besides, in European Russia, 104 local detachments which escaped disbandment, and which, as already noticed, take charge of the stores of some of the line infantry depôt battalions in peace, and serve as nuclei for the latter on mobilization. There are, again, in the Caucasus, 3 local battalions and 59 local detachments; in Turkestan, 3 local battalions and 20 local detachments; in Siberia, 6 local battalions and 80 local detachments. The establishments of these units vary so much in strength that it is difficult to arrive at even an approximate estimate of their total numbers, but these are reckoned to be as follows in "Armed Strength" :—

18 local battalions (750)	....	....	....	....	13,500
303 local detachments	....	....	....	....	38,227

Approximate total 51,727

Local troops are recruited in the same manner as the troops of the regular army, and are raised to a war-strength from the reserve, and, if necessary, from the Opoltschenié.

Fortress Artillery.

This has already been noticed when treating of the artillery in general.

There are, however, in addition to the fortress artillery battalions, a considerable number of local artillery detachments, of a total strength of 82

Officers and 3,797 men, distributed in very unequal numbers at seventeen stations. These detachments take charge of all artillery *matériel* stored in open towns. Their strength is not increased in time of war.

General Summary of Fortress and Local Troops.—Infantry and Artillery.

In peace :—

Fortress troops	....	....	....	28,792
Local troops	....	....	....	51,727
Total	....	....	....	80,519

In war :—

Fortress troops	....	....	....	80,007
Local troops	....	....	....	51,727
Total	....	....	....	131,734

Instructional Troops.

These consist of infantry, cavalry, artillery, and engineers, and are kept up for the purpose of maintaining uniformity of drill, and for testing the value of proposed changes in drill and equipment. With the exception of a small detachment in the Caucasus, all the instructional troops are quartered at St. Petersburg.

A variable number of Officers, non-commissioned officers, and private from the active army are attached to them—the course of training lasting two years and a-half ; the detached men being changed annually, and rejoining their regiments as instructors.

Vacancies in the permanent staff are filled by selection from the men under instruction. If necessary, the instructional troops can be mobilized.

Infantry.

1 Battalion at St. Petersburg.					1 Company at Tiflis.				
Officers	....	....	....	24	Officers	....	....	....	....
Classed officials	....	....	....	5	Classed officials	....	....	....	....
Non-commissioned officers	....	....	....	185	Non-commissioned officers and	....	....	....	....
and men	....	....	....	233	privates	....	....	....	5
Non-combatants	....	....	....	447	Non-combatants	....	....	....	....
Total	....	....	....	447	Total	....	....	....	6
Horses	....	....	....	6	Horses	....	....	....	....

The instructional battalion has four companies of infantry, one company rifles, one company of musicians for teaching drummers and buglers, and one company of non-combatants.

The variable establishment of the St. Petersburg battalion amounts to maximum of 82 Officers and 875 non-commissioned officers and private and that of the Tiflis Company to a maximum of 50 Officers and 397 men.

Cavalry.

One squadron at St. Petersburg, the permanent staff of which is as follows :—

Officers, 10 ; classed officials, 6 ; non-commissioned officers and private 102 ; non-combatants, 143. Grand total, 261.

Horses, saddle, 317 ; draught, 6. Total, 323.

The variable establishment amounts to about 61 Officers and 262 non-commissioned officers and privates.

Artillery.

One field battery with 4 light and 2 mountain guns horsed, and 1 horse artillery battery with 6 guns horsed, one division being Cossacks.

The permanent staff is as follows :—

Field Battery.				Horse Battery.			
Officers	...	...	8	Officers	...	...	8
Classed official	...	...	1	Classed officials	...	...	3
Non-commissioned officers and				Non-commissioned officers and			
privates	...	...	45	privates	...	...	104
Non-combatants	...	...	64	Non-combatants	...	...	70
<hr/>				<hr/>			
Grand total	...	...	118	Grand total	...	...	185
Horses :—				Horses :—			
Saddle	...	...	19	Saddle	...	...	99
Artillery draught	...	...	37	Artillery draught	...	...	53
Train	...	...	6	Train	...	...	6
<hr/>				<hr/>			
			62				158

Officers and men are sent for instruction from every brigade of artillery of the active army, and from the reserve brigades.

Engineers.

The electrical instruction company, already noticed when treating of engineer troops generally, is stationed at St. Petersburg, and comprises as follows :—

Officers, 4 ; non-commissioned officers and privates, 240 ; non-combatants, 18. Grand total, 262. Draft horses, 4.

The course of instruction lasts for one or two years, being both theoretical and practical, and attended by both Officers and men.

Special Corps.

1. The corps of topographers.
2. The corps of couriers.
3. The company of Palace Grenadiers.
4. The pensioners.
5. The gendarmerie.
6. The disciplinary battalions.
7. The military works department.

1. The corps of topographers is under the headquarter staff, and is employed in making surveys and maps. The *personnel* consists of 339 Officers. The annual grant to the department amounts to 109,226*l.*, of which 39,711*l.* is devoted to the production of maps and plans.

2. The corps of couriers consists of picked Officers and non-commissioned officers, who are employed in carrying important despatches, and in performing orderly duties about Court. The ordinary establishment comprises 48 Officers and 81 men ; the increased establishment comprises 56 Officers and 101 men.

3. The company of Palace Grenadiers performs guard duty at the Winter Palace at St. Petersburg, and at the Kremlin at Moscow. It is recruited from the Guard, is under the Ministry of the Imperial Household, and under immediate command of one of the Imperial aides-de-camp. It is composed of :—

- 1 Colonel Commanding.
- 7 Officers.
- 16 non-commissioned officers ranking as Officers.
- 142 Grenadiers.
- 3 drummers.
- 2 flute players.
- 12 non-combatants.

Total of all ranks 183

4. The pensioners. This corps consists of old soldiers of good conduct who have distinguished themselves in the field. There are sixteen regiments of Caucasian Grenadiers (pensioners), having each an establishment of 12 Officers, 16 non-commissioned officers, 90 privates, 3 miscellaneous, 2 Officers' servants. Total, 123 ; and 4 battalions of Caucasian Rifles (pensioners), each having 5 non-commissioned officers and 65 privates. Total, 70. So that there are altogether 2,248 of these pensioners.

5. The gendarmerie. This force consists of two portions, first, the ordinary police ; secondly, the military police. The former is divided into three divisions, six independent detachments, and a railway corps. The three divisions are stationed : 1, at Moscow ; 2, at St. Petersburg ; 3, at Warsaw ; their united strength being 72 Officers, 148 non-commissioned officers, 10 trumpeters, 1,031 rank and file, 8 officials, 133 non-combatants, with 754 saddle horses, and 16 draught horses.

The total strength of the independent detachments amounts to 3 Officers, 17 non-commissioned officers, 89 rank and file, and 3 non-combatants, with 70 saddle horses and 10 draught horses.

The railway corps musters 63 Officers, 1,007 non-commissioned officers, 95 rank and file, with 12 saddle horses.

The military police form six cadres, one of which is for the Guard and is stationed at St. Petersburg. The other five are at Vilna, Warsaw, Kijev, Odessa, and Tiflis. They are under the direct orders of the Chief of the Staff of their respective districts. On mobilization each centre forms a squadron for service with the field army. The establishments are as follows :—

Combatants.	Guard.		Line.	
	Cadre in peace.	Squadron in war.	Cadre in peace.	Squadron in war.
Officers—				
Colonel commanding.....	1	1	1	1
Other Officers.....	4	7	3	9
Total Officers.....	5	8	4	10
Quartermaster-sergeants.....	2	5	2	5
Sergeants.....	28	96	28	144
Trumpeters.....	2	4	2	4
Gendarmes.....	10	—	—	—
Total combatants.....	47	113	36	163
Non-combatants.....	15	21	15	24
Horses—				
Officers'.....	5	8	4	10
Troop.....	32	105	18	153
Draught.....	3	8	3	8

The Officers are taken from the Army, in which they must have served least five years. They must also have been educated at a middle class school and must go through a term of probation before being finally appointed to the gendarmerie. The ranks are filled with men who volunteer from the reserve or after final discharge. They must have good characters, and must serve five years in the corps. A gendarmerie reserve of 70 non-commissioned officers is being formed.

6. The disciplinary battalions. There are four battalions, each of four companies, stationed in Europe and the Caucasus, and three disciplinary companies in Asia. These corps receive men under sentence of court-martial, and also those removed from their regiments as refractory subjects. The Commanding Officers are specially selected. Half the permanent staff consists of non-commissioned officers who have re-engaged; the other half of men of exemplary conduct selected from regiments in the district.

7. The military works department is charged with the construction and repair of fortresses, barracks, &c., and with the care of all engineer stores. The *personnel* is divided into sections, varying much in strength and scattered over the whole Empire.

We have no information as to the composition, nor as to the total strength of this corps.

Irregular Troops.

As we have already stated, the Cossacks are usually included under this head, but for reasons which appeared to us sufficient, we classed them with the field troops of the regular army to which the bulk of them virtually belong. The only "irregular" troops properly so called which remain to be mentioned are the Caucasian Militia Corps, which are recruited by voluntary enlistment from amongst the natives, are permanently embodied, and are employed locally chiefly for police duties. They are as follows:—

The Daghestan Cavalry Regiment of 6 sotnias (793 men).

The Kutais Cavalry Regiment of 4 sotnias (652 men).

The Kuban Militia of 1 sotnia (87 men).

The Terek Militia of 11 sotnias (1,276 men).

The Daghestan Militia, 11 sotnias (1,238 men).

1st Akhaltsikh, 1 sotnia.

The Grusian drujina (dismounted regiment), 4 sotnias (in peace, 277, in war, 32).

The Grusian drujina, 4 sotnias (836 men).

The militia for Kars, 3 mounted sotnias.

The militia for Batoum, 1 mounted sotnia.

The militia for Batoum, 3 infantry sotnias.

During the Russo-Turkish War of 1877-78 some 15 to 18 regiments of regular cavalry and several battalions of infantry were raised from amongst the warlike tribes of the Caucasus by offering a high rate of pay, and some of these bodies at least took part in the operations.¹

THE OPOLTSCHENIE.

This force corresponds to the German "Landsturm," consisting of all men fit for service between the ages of 20 and 40, whether they have served with the colours or not. They are called Ratniks, and are divided into two categories, to the first of which belong the men who have been less than four years in the force, including those who have already served their time in the army and reserve, being between 35 and 38 years of age, leaving all the remaining Ratniks to compose the second category, which is only liable to employment as a militia for home defence. The first category may, however, be used either to form distinct battalions and squadrons of the Opoltschenie or to reinforce either the field army, the reserve troops, or the depôts.

The men of this force are in great part untrained, but when the Conscription Law of 1874 is in full bearing, that is to say, in 1889, the proportion of

¹ The attack on Batoum was carried on at first by the three Georgian militia regiments, which are maintained only in a skeleton state in peace-time. They are described as being, at the time of the attack, "several thousand strong and quite regular. The bulk of the men had never been trained to the use of arms."

those who have served in the regular army will be largely increased. The numbers of the Opoltschenié will eventually be very large, for in the three years 1874-76 the conscripts passed directly into it, as being over and above the contingent required for the regular army, numbered 1,200,000. It would be difficult to form even an approximate estimate of the total strength of the force, nor would such an estimate, even if reliable, be of any practical use, as the second category, composing the bulk of the array, can only be employed locally in case of invasion, a contingency not likely to occur except in a very small portion of the Empire. With regard to the first category, however, which, as we have seen, may be used to augment the active army, we have some definite information, being told that on the 1st January, 1881, it comprised 1,873,738 men, including about 500,000 who had been soldiers.

In 1877, during the Turkish War, 185,467 men of the Opoltschenié were actually embodied. No cadres are maintained for the force in time of peace, but the names of Officers, particularly of those of superior rank, who are to be appointed to it in case of its being called out, appear in the scheme for mobilization. Equipment of every description for some 200 battalions and some 50 squadrons is constantly maintained in the commissariat magazines (in great measure in the western provinces), the cost thereof being defrayed by the communes (*semstvos*).

In each province there is a "Chief of the Opoltschenié," who is assisted by a staff of two Officers and seven non-combatants. The force, when embodied, which can only be done by Imperial decree, is formed into battalions (called "*drujinas*," an old Slav word meaning society or association, derived from *drug*, a friend), squadrons of cavalry, called "*sotnias*" (hundreds), and marine detachments. The "*drujina*" consists of four companies. The establishments of the *drujina* and of the *sotnia* are as follows:—

	Commanding Officers.	Captains.	Sub-lieutenants.	Sergeant-majors.	Sergeants.	Corporals.	Drummers.	Buglers or trumpeters.	Privates.	Total combatants.	Surgeon.	Non-combatants.	Servants.	Troop horses.
<i>Drujina</i>	1	4	8	4	20	56	5	1	548 to 900	647 to 999	1	13	14	
<i>Sotnia</i>.....	..	1	2	1	4	8	..	1	125	142	..	4	4	134

Regimental Trains.

	<i>Drujina.</i>	<i>Sotnia.</i>
Treasure and archives wagon	1	..
Provisions and cooking-pots	4	1
Mess cart	..	1
Draught horses	15	4

The Corps of Officers.

Since the introduction of general liability for military service without distinction of class, the grade of Officer has been open to every Russian subject who possesses the very moderate degree of education demanded by regulation (see below), who has served satisfactorily for the required periods as private and non-commissioned officer, and finally who has passed the professional examination which concludes the course at the cadet schools. As, however,

an educated middle class is only now beginning to exist in Russia, and as but comparatively few conscripts (generally, as before remarked, utterly uneducated at the commencement of their service) are able during the same to qualify themselves for the educational and professional tests, the majority of the Officers has hitherto belonged to the class of hereditary nobles or to that ennobled for services, either military or civil. Notwithstanding the similarity of origin amongst the Officers of the Army, the educational level has always varied greatly, being affected less by the question of birth than by that of money, for there is in Russia a large proportion of nobles with such small means as to prevent them from giving their children the advantage of a really good education, even if they wish to do so, which is not always the case. The sons of rich parents have hitherto, as a rule, entered the Guard or the cavalry, and we find that these Officers, as well as those of the special arms, are remarkable for a high degree of education, particularly as regards knowledge of languages, whilst the great majority of their comrades had received merely elementary instruction before entering the Service. In former days the *cadet corps*, to which there were many free admissions, served as nurseries for the corps of Officers, and many of the older Russian Officers, gallant soldiers indeed, but as a rule without much theoretical knowledge, were brought up in these corps, the last survival of which are the Imperial Corps of Pages and the Cadet Corps of Finland. In place of these establishments there are now eighteen military gymnasias and eight progymnasias (preparatory schools), each of which has a complete organization, the pupils wearing uniform and being divided into companies.

In the former, boys of the noble class are received at 10 years of age and educated for the *cadet* (or so-called *war*) schools. They have to undergo an entrance examination, and the course lasts seven years. Each pupil is supposed to pay 250 roubles annually for board and instruction, but many are admitted free on account of the position or circumstances of their parents.

The course includes religious instruction, the Russian, French, and German languages, mathematics up to plane trigonometry, geography, history, gymnastics, &c., drill, the elements of the natural sciences.

There are now 6,875 pupils in these schools, of which three are at St. Petersburg, four at Moscow, and the remainder scattered over the Empire.

In the year 1880, 530 youths passed into the infantry and cavalry *war schools* and 75 into those of the artillery and engineers from the gymnasias. The *progymnasias* also take boys of about 10 years of age, principally sons of Officers and of civil officials, but in Asia without any distinction as to class. They must be able to read and write, and must know the elements of arithmetic before entering. The course lasts four years, and pupils who pay contribute 150 roubles yearly.

The total number of scholars now in progymnasias is 1,700; 290 youths joined the Army as non-commissioned officers from these schools in 1880 and 13 joined the military schoolmaster's seminary.

Pupils on completing the course pass into the "Junker" schools (*war schools*) of a lower standard. The *cadet* (or *war*) schools take boys who have passed through the *gymnasias* and educate them to be Officers. There are eight of these institutions, including the above-mentioned *Finland Cadet Corps* and the *Imperial Corps of Pages*. Of the remainder the *Paul War School* and the *Constantine War School*, both at St. Petersburg, also the *Alexander War School* at Moscow, are for infantry only and accommodate 300 pupils each; the *Nicholas War School*, at St. Petersburg, is for cavalry, and can receive 200 pupils. There is also the *Michael Artillery War School*, with 160 students, and the *Nicholas Engineer War School*, with 120 students. The course in the infantry and cavalry schools lasts two years. About 400 Officers pass annually from them into the infantry and from 80 to 90 into the cavalry. Students are admitted between the ages of 16 and 20 if they have gone satisfactorily

through one of the *gymnasia*, or through a civil upper class school, or if they have passed an entrance examination.

Students have the rank of cadet and pay 64*l.* 8*s.* each for board and instruction. There are, however, a good many free admissions. Instruction is given in all professional subjects, also in religion, modern languages, history, statistics, natural history, and chemistry.

In the cavalry schools riding and hippology are also taught. Those who pass out as "excellent" are appointed *Sub-Lieutenants*, the "very good" become *Ensigns* and *Cornets*, the "good" are called cadets, are attached to regiments, and after six months' good service are promoted to the rank of Ensign.

The course in the *artillery* and *engineer schools* lasts three years. Candidates for admission must have gained a "good" certificate at a *gymnasium* or *war school*, or must pass an entrance examination. Minimum age of admission, 17. The course of instruction is similar to that in the infantry and cavalry schools with the addition of mathematics and subjects relating specially to the scientific arms. At the end of the course students reported "excellent" or "very good" are appointed—the former *Sub-Lieutenants*, the latter *Ensigns*—in the artillery or engineers respectively; whilst those who are only "good" become cadets in the infantry or cavalry. The *Finland Cadet Corps* is at Helsingfors. The pupils are exclusively Finlanders, must pass an elementary examination on entering, and are received up to 12 years of age. A great many of them are on the foundation; the remainder pay 22*l.* 10*s.* annually.

There is accommodation for 120. About twelve pass out every year into the cavalry or infantry of Finland. The course lasts eight years, and includes all subjects taught in the *progymnasia*, *gymnasia*, and in the *war schools*.

The *Imperial Corps of Pages* is the most aristocratic cadet school in Russia, and is established at St. Petersburg. Admission is obtained only by direct order of the Emperor at between the ages of 12 and 17. The wealthy pay 116*l.* 13*s.* a-year, others are educated free of expense. Those who pass out with the best certificates are appointed *Sub-Lieutenants* or *Ensigns* in the Guard, the less successful join the line as *Ensigns*. About eighteen Officers are furnished to the Army annually from this corps.

The *Junker* schools are sixteen in number, divided pretty equally amongst the military districts, and the formation of an additional one for Turkestan is proposed. Those now in existence contain altogether 4,485 pupils, of whom 3,380 are for the infantry, 480 for the regular cavalry, and 625 for the Cossacks. In 1880, 1,284 Officers were furnished to the Army by the *Junker* schools.

Candidates for admission to them must have gone through one of the *progymnasia*, or must pass an entrance examination. Non-commissioned officers still serving are allowed to enter with a view of qualifying for the rank of Officer.

The course lasts two years, the first of which is devoted principally to general subjects, the second more especially to professional subjects. Drill, gymnastics, and fencing, and in the cavalry schools riding and vaulting, are carried on during each year's course. During the summer months the cadets join camps specially formed for them. At the termination of the first course cadets classed as "very good" are appointed *Ensigns* at once, whether there be vacancies or not; those classed as "good" are appointed as vacancies occur. The *Junker* schools are under the staff of the military district in which they are established, the first examinations being conducted by Commissions appointed by the General-Governors.

The Officers of the Russian Army may be divided into four classes with regard to their education previous to entering the Service:—

1. The few who have had an university or academical education.
2. Those who have been brought up in *gymnasia*, military or civil, in the

Corps of Pages, or the Finland Cadet Corps, and who generally join the Guard or the special arms.

3. The great majority who have received an elementary education in the lower civil schools, such as those of towns or communes, or in the military *progymnasia*.

4. The very small number who, by means of private study, or of the instruction gained in the regimental schools, have qualified for admission to the Junker schools, and have passed from them into the Army.

Drygalski gives some curious statistics as to the educational and social status of the Officers. According to him, in the year 1880, 189 volunteers joined the Guard as aspirants to the rank of Officer. Of these, 25 belonged to the first educational class, 140 to the second, and 24 to the third. In the same year 5,870 aspirants joined the rest of the Army, of whom only 46 belonged to the first educational class, 795 to the second, and 5,029 to the third. Again, three of the great categories of preparatory military schools contained the following percentage of the different social classes in 1881 :—

	War schools.	Military gymnasia.	Pro- gymnasia.
Sons of hereditary nobles	65·29	72·84	36·27
„ official nobility	5·96	10·31	13·70
„ Officers and officials	12·64	11·35	34·48
„ the clergy	2·03	0·61	2·62
„ Cossacks	4·5	0·33	6·52
„ soldiers .....	..	0·15	3·85
„ various classes	9·58	4·30	2·56

In addition to the above there was a small proportion of Southern Slavs.

We see from this table that the sons of hereditary nobles preponderate in the military *gymnasia* and in the war schools fed by those institutions, whilst the sons of official nobles and of non-titled Officers and officials form the most numerous class in the *progymnasia*, whence they pass into the *Junker schools*. If we continue our examination into the Army itself we find that the hereditary nobility hold the greater part of the commissions in the Guard, whilst in the rest of the Army they form still about one-half of the corps of Officers. At the same time, in Russia, as elsewhere, the mere aristocrat is giving way to the plutocrat, and this is shown even in the matter now before us, for it is remarked that sons of rich men, sprung from the lower class, but who made their fortunes in trade, are to be found in the most exclusive regiments of the Guard and in the cavalry, whilst, on the other hand, many a representative of the oldest and most distinguished families in the Empire is serving in an ordinary infantry regiment or vegetating in some local corps on the Asiatic frontier. Amongst these latter are many Officers of foreign extraction, particularly Germans and Poles, and to these may now be added gentlemen of Georgian, Armenian, and other Caucasian races, besides many descendants of Tartar princes, richer in titles than in roubles. It will be evident to our readers, from the sketch above given, that the Officers of a Russian regiment are not likely to form such a homogeneous body as in some other armies, and indeed, until very lately, this peculiarity was very manifest. *Esprit de corps* was almost unknown. The Officers of a regiment were broken up into sets without reference to their grades, like consorting with like, and those belonging to one clique seeing but little of their other brother Officers except on duty. The events of the late war appear to have somewhat modified this state of things; in some regiments which distinguished themselves against the enemy the regimental

spirit has been developed, and the authorities appear inclined to foster this feeling, regimental casinos having been encouraged, and intercourse between Officers being more carefully regulated by the institution of regimental courts of honour, as in Germany, and by insisting upon the maintenance of a proper subordination on the part of junior Officers when mixing with their superiors off duty. Of course time is required to work any great change in this matter, but already symptoms of greater unity in the corps of Officers are visible, both in the cavalry and in the scientific corps, in the case of the former probably in great measure owing to the manner in which regiments are broken up into small detachments in country quarters, where Officers are restricted to the society of their comrades and of the neighbouring country gentlemen, whilst the higher scientific education of the artillery and engineers imparts to units of those arms a special individuality.

Rifle battalions and Grenadier regiments are considered crack corps, and Officers of local corps are inclined to look down upon those of the line, probably because the latter, being less settled, are not so well accustomed to the forms and manners of society as the former, who occupy permanent quarters in the larger garrison towns.

Pay and Allowances of Officers.

Pay.

	Normal.			Increased.		
	Old Guard.	Young Guard Artillery Technical Corps Staff.	Infantry, Cavalry, and Rifles.	Old Guard.	Young Guard Artillery Technical Corps Staff.	Infantry, Cavalry, and Rifles.
<i>Active.</i>	£ s.	£ s.	£ s.	£ s.	£ s.	£ s.
General.....	..	293 4	..	..	439 17	—
Lieutenant-General.....	..	234 12	..	..	351 17	—
Major-General.....	..	175 19	..	..	263 18	—
Colonel.....	118 17	118 17	118 17	187 6	187 6	187 6
Lieutenant-Colonel.....	..	91 18	91 18	..	137 18	137 18
Major.....	..	..	..	..	..	114 2
Captain.....	91 18	76 1	76 1	137 8	114 2	95 2
Staff (2nd) Captain.....	76 1	63 8	63 8	114 2	95 2	87 19
Lieutenant.....	63 8	58 13	58 13	95 2	87 19	80 17
Sub-Lieutenant.....	58 13	53 18	53 18	87 19	80 17	76 2
Ensign or Cornet.....	53 18	50 14	47 11	80 17	76 2	71 6
<i>Supernumerary.</i>						
General.....	..	226 13	..			
Lieutenant-General.....	..	181 10	..			
Major-General.....	..	136 6	..			
Colonel.....	81 13	81 13	81 13			
Lieutenant-Colonel.....	..	68 3	68 3			
Major.....	..	..	54 14			
Captain.....	68 3	54 14	49 19			
Staff (2nd) Captain.....	54 14	49 19	45 19			
Lieutenant.....	49 19	45 19	38 17			
Sub-Lieutenant.....	45 19	38 17	36 9			
Ensign or Cornet.....	38 17	36 9	34 2			

Every Officer is entitled to quarters, or to lodging allowance, the latter varying in amount according to the class of garrison (of which there are five) in which the Officer is quartered.

The lodging allowance of a

	£	s.		£	s.
General ranges between a maximum of....	317	0	and a minimum of	79	5
Lieutenant-General ranges between a maximum of	237	15	„ „	63	8
Major-General ranges between a maximum of	158	9	„ „	47	11
Colonel of a regiment ranges between a maximum of	126	16	„ „	39	12
Field Officer ranges between a maximum of	79	5	„ „	23	16
Captain ranges between a maximum of	47	11	„ „	15	17
Subaltern „ „	31	14	„ „	10	14

Officers' families receive a gratuity on loss of quarters and lodging allowance in time of war.

Table Money (raised considerably in 1881).

	£	s.
General commanding an Army Corps	475	10
„ „ a Division	380	8
Brigadier-General	285	6
Officer commanding a regiment, or senior Staff Officer	289	2
„ „ an independent battalion or battery	173	11
„ „ a battalion of infantry or a wing of cavalry	115	10
Junior Field Officers....	86	10
Squadron or company commander	58	0
Regimental staff	43	15
Subaltern	29	0

Messing Allowances.

A messing allowance is granted in addition to table money to all Officers quartered in Eastern Siberia and also to certain subalterns in lieu of table money, to all Staff Officers, those attached to instructional corps, to commandants of fortresses, of local troops and of étappen posts. The rates are as follows :—

	£	s.
Commander of an Army Corps, or equivalent	380	8
„ a Division, or equivalent	237	15
Brigadier-General	142	13
Officer commanding a regiment	190	3
„ „ a battalion	95	2
„ „ a squadron { From 95 <i>l.</i> 2 <i>s.</i> down to		
„ „ a battery { 9 <i>l.</i> 10 <i>s.</i> , according to		
„ „ a company { arm and corps.		
Subaltern	15	4

Subsistence allowance (1*s.* 11*d.* a-day for Field Officers and 11*d.* a-day for others) is granted during manœuvres and on some other special occasions.

On mobilization the following allowances are granted to Officers and military officials :—

- A gratuity on taking the field.
- Allowance in lieu of rations and forage.
- Allowances to Officers' families.

The gratuity consists of a sum for an outfit varying between 48*l.* for a General to 16*l.* for a Captain, besides 24*l.* for each additional charger which an Officer has to purchase to make up the regulation number. Generals and any other Officers whose baggage does not accompany the troops are entitled to a sum for the purchase of baggage-wagons and carts.

There are also other extraordinary allowances granted on special occasions which we have not space to mention.

Forage Allowance.

All mounted Officers are obliged to keep one horse in peace-time, for which they are entitled to forage, except Commanding Officers, who procure their own forage. If a second horse is kept forage may be drawn for it.

The daily ration is as follows :—

	Oats.	Hay.	Straw.
	Pecks.	Lbs.	Lbs.
Chargers belonging to Generals, to Officers of the Staff of Infantry, and of Artillery	1·08	9	2·7
Chargers of Officers of the Guard	1·44	9	3·15
" " " Cavalry	1·35	9·03	2·47

In time of war the number of forage rations is increased, and all Officers, whether mounted or not, draw a daily allowance in money consisting of a number of portions varying according to rank, and each portion amounting to 2½*d.*

At page 150 of "Armed Strength" will be found a table showing the number of forage rations and portions to which each rank is entitled. Forage is only supplied in kind where it cannot be bought.

Servants' Allowances.

Generals are allowed three, Field Officers two, and other Officers one soldier servant each, who continue to draw the same pay as when in the ranks. Married Officers of all ranks are allowed an extra servant. The sum of 14*l.* a year is allowed in lieu of each servant not required.

Ration Allowance (daily).

					In the field.		On the march.	
					s.	d.	s.	d.
Officers commanding regiments	....	....	....	....	12	8	....	6 4
Other Field Officers	....	....	....	....	6	4	....	3 2
Captains	....	....	....	....	3	2	....	1 7
Subalterns	....	....	....	....	1	11	....	0 11

Officers as a rule provide their own rations in time of war. When this cannot be done they are entitled to the same ration as the private, with the addition of 1 lb. of meat and about half-a-pint of brandy.

Presents.

It is the custom in the Russian Army for presents to be granted to Officers by the Emperor for distribution on his birth- or name-day, and on other special occasions. No Officer may receive more than 17*l.* in any one year.

Regiments bearing the name of the Emperor receive large donations of money for distribution to all ranks on certain festivals.

It will be seen from the foregoing that though the actual pay of the Russian Officer is small it is largely supplemented by the very liberal allowances, and in fact very many, perhaps the majority, of Officers live on their pay, with all the more comfort on account of the prevailing hospitality, the houses of the well-to-do being open to the poorest Officer as long as his manners and education are such as render him fit for society. Up to the age of twenty-eight an Officer must prove that he has a private income of at least 35% a-year before he is allowed to marry; after that age he need only obtain the consent of his Colonel irrespective of his means. No Officer is allowed to marry before the age of twenty-three.

Promotion of Officers.

Promotion during peace is made by the Emperor; during war by the Commander-in-Chief of an army in the field, subject to the sanction of the Emperor. In the infantry, rifles, and cavalry, promotion goes by seniority up to the rank of Captain. Officers of each rank, up to Captains inclusive, are on one general list for promotion by Divisions of infantry and cavalry and by double brigades of rifles. Above the rank of Captain promotion is by selection, all those who have held the lower rank for two years, or in the case of Captains for three years, being eligible as candidates.

In the artillery promotion goes by seniority up to Lieutenant-Colonel, above that rank by selection. Officers of the lower grade are placed on the following separate lists for promotion.

Field artillery of the Guard.

"	"	"	line.
Horse	"	"	Guard.
"	"	"	line.
Garrison artillery.			

Engineers.

The same rules for promotion as in the artillery. There are two lists, one for the Guard battalion, the other for the remainder of the corps. Up to the rank of Captain each step of promotion takes place every two years, the requisite number of vacancies being created by placing a sufficient number of Captains and 2nd Captains on the list of candidates for promotion to field rank in the infantry or cavalry.

General Staff.

The Officers are placed on one list, getting one step every two years, if qualified, up to the rank of Captain. A Captain, after three years' service as such, and after passing a practical test as Field Officer, is promoted to the rank of Lieutenant-Colonel, after which the same rules hold good as for the rest of the Army. The Chief of the Headquarter Staff may direct junior Officers' names to be placed on the list of candidates for regimental field rank. The General Staff is recruited solely from Officers who have taken honours in the General Staff Academy. The comparative rate of promotion is considerably affected by the fact that there are no Lieutenant-Colonels or Majors in the Guard, and no Majors in the scientific corps except in that of the local engineers. Captains in the Guards, therefore, rise on promotion at once to the rank of Colonel, and those of the scientific corps to the rank of Lieutenant-Colonel, even if transferred to the line. Thus from this it arises that promotion by selection being, as we have seen, the rule in the higher ranks, there is a great opening

for pushing on young Officers from the favoured corps to the detriment of their less fortunate comrades in the mass of the Army, and a great many guardsmen particularly get promotion by transfer over the heads of older Officers. This system, no doubt, gives the authorities the power of pushing on young Officers of merit to positions of trust and responsibility, where their talents will benefit the country, and there are cases where this power is exercised, but it is to be feared that the system is worked more for the benefit of individuals than for that of the country, as it is remarked that a large proportion of the Officers thus advanced owe their promotion to Court favour and to social position rather than to professional experience or ability. After the late war the list of promotions on account of "distinguished conduct in the field" was very large, including 44 Generals, 670 Staff Officers, and 924 Field Officers; 5,474 Officers (more than 15 per cent. of the whole number), were decorated. In 1879, the number thus honoured amounted to 9,456. Profusion in the distribution of honours for military service is, however, not peculiar to Russia, but is rather a characteristic of the age we live in. In 1881, the number of Officers attached to the Imperial suite—a position which is very often the stepping-stone to high command—was as follows:—137 General Adjutants, 121 unattached Generals, 146 Field Officer Adjutants.

The following schools are available for the higher education of Officers:—

The Nicholas General Staff Academy.

This academy is at St. Petersburg, and is open to all Officers of and below the rank of Major in the line, 2nd Captain in the Guard or in the scientific corps. They must have served three years regimentally, and have passed a preliminary examination, from which, however, Officers of the St. Petersburg garrison are exempt.

The successful candidates are relieved from all regimental duties for four months, after which time they must undergo the special entrance examination at the academy. Those placed highest on the list are admitted, the remainder returning to their regiments, and being informed whether they will be allowed to compete a second time. A third attempt is never allowed. The course lasts two years, and the number of students is limited to 120, including 20 in the geodetical division. If an Officer has not made good progress at the end of his first year's course, he is sent back to his regiment, but may be allowed to come up again for the entrance examination with the consent of the head of the academy. Direct admission to the second year's course may be obtained on passing the final examination of the first year's course.

At the end of each year students are classified as "excellent," "very good," "good," and "insufficient." The first class receives on leaving the large silver medal, the second class the small one.

Those at the head of the "excellent" class receive gold medals; and, if below the rank of Major, a step of promotion, but if of that rank, one year's pay. The medallists are appointed to the General Staff as vacancies arise. The celebrated General Dragomirow, so well known as a military writer and as a tactician of the go-ahead school, is now at the head of the academy, which has gained much from his ability and practical good sense, and has become not merely a preparatory school for Staff Officers, but also an emporium of military science, by which the whole Army may profit. With this view before him, he started public lectures on interesting military subjects at the academy during winter, which lectures are largely attended—an example followed by some of the other military schools.

The Russian General Staff is now formed and regulated very much after the fashion of that of the German Army. Clerical work, which formerly took up most of the time of the General Staff Officers, now devolves upon a separate

branch of the Staff, whilst the genuine Staff Officer has time to devote himself to the more active and scientific part of his profession. The Staff Officer is obliged from time to time to join a regiment for duty, and to remain a while with it, so that he may not forget the details of regimental work, nor lose the habit of commanding men. General Staff journeys take place annually in summer months in the western frontier districts, also reconnaissances on a large scale. The winter is devoted chiefly to theoretical instruction. The instruction of the Staff Officer is very comprehensive, and it is not surprising that so large numbers of able military writers should be found in its ranks—men such as Leer, Seddeler, Kaulbars, Lewitzki, and many others, the reputation of some of whom has extended beyond the limits of the Empire.

The *Michael Artillery Academy* is at St. Petersburg, and admits 30 Officers annually, besides 25 Cossack Officers, the course extending over two years. All artillery Officers below the rank of Staff Captain (or Lieutenant in the Guard) who have done regimental duty for two years, and have passed certain examinations, are eligible for admission. Officers of other arms are also admitted on the same terms, after doing one year's service with the field artillery.

The course of instruction includes ballistics and everything connected with the history and science of artillery, also higher mathematics, the natural sciences, geometrical drawing, and riding.

During the summer months students are sent to visit Government and private technical establishments, &c. On leaving the academy they are attached to the Guard for one year. A cross is conferred upon those who specially distinguish themselves.

The *Nicholas Engineer Academy* is also at St. Petersburg, and admits 35 Officers annually for two years. Engineer Officers are eligible for admission on the same terms as those of artillery to the *Michael Academy*. The course of instruction includes the subject of fortification in all its branches, construction of buildings, waterworks and roads, architecture, higher mathematics, geometrical drawing, geodesy, chemistry, mineralogy, military history and administration, and artillery. During summer the students are sent to visit fortifications and other engineering works. The highest on the list, on leaving, are appointed to the engineer staff, crosses being given to those specially distinguished. The remainder rejoin their regiments. Extra students are admitted to the Artillery and Engineer Academies in the same manner as to the Staff Academy.

The *Military Law Academy* is at St. Petersburg, and receives 25 students annually for two years. Officers must have served four years regimentally, have obtained certain certificates, and have passed an entrance examination, before they can gain admission. The course of instruction includes all subjects connected with Russian civil and military law, and the military codes of foreign countries.

Officers who pass good final examinations receive crosses and appointments in the judicial department of the Army.

The whole of the Officers of the Russian Army and Navy, also other Government officials, civil and ecclesiastic, are divided into classes, of which there are fourteen. The entrance examination for an aspirant of the 3rd category and the lowest (14th) class of official is the same, and a cadet passing out of one of the war schools with a 1st class certificate, but physically unfit for army service, is admitted to the 12th class of officials. If he remains in the Service he advances from class to class.

Exchanges between Officers and civil officials of the same class are allowed. A town councillor has the relative rank of Colonel, and a chief councillor that of Major-General, and, like that Officer, the title of "Excellency." You often hear in Russia a distinction between the "civil" and "military" General ;

and foreigners find it hard to distinguish between the two, as they both wear somewhat similar uniforms.

Many Officers leave the combatant branch for the civil department of the Service, in that case adding a civil title to that of their military rank.

A step of rank is generally given on leaving the Service, also permission to wear uniform. If a retired Officer re-enters the Service, which happens very often, even without being called out on mobilization, he generally resumes the rank which he held on leaving it.

Officers' pensions are of two kinds : State pensions and those derived from the Pension Fund.

State pensions are given to Officers retiring after 35 years' service, or in consequence of wounds, almost amounting to the full pay of the rank conferred on retirement ; to those retiring after 25 years' service, pensions equal to half-pay.

Years spent on service in the field count double, and each month spent in the defence of Sevastopol counts as a year. Officers obliged to leave the Service in consequence of ill-health after 10 years receive a pension equal to one-third of their pay ; after 20 years, to two-thirds of it ; and after 30 years, to full pay. Should they retire from ill-health, be unable to maintain themselves, and require the care of another person, they are entitled, after 5 years' service, to one-third of their pay ; after 10 years' service, to two-thirds ; and after 20 years' service, to full pay.

Pensions from the fund vary in amount according to length of service and to the number of years during which the recipient has contributed to the fund. In case of the death of an Officer entitled to a pension it goes to his family. No pensions are given to Officers who have contributed for less than 5 years. Those who have served between 25 and 35 years are entitled to half-pay ; those who have served 35 years, to full pay. In case of wounds or incurable disease the rate of pension is calculated in all cases as for Officers who have served 35 years, and varies only according to the number of years during which the pensioner has contributed to the fund. The scale is said to have been lately raised 17 per cent. all round.

The list of reserve Officers and officials is kept in each military district. It comprises all those fit for service who have left the Army before the completion of the legal period. There is a project for adding to their numbers a special body formed of the numerous educated men who, having served in the ranks the limited term prescribed by regulation for men of their acquirements, prefer leaving the Service to accepting the commissions to which they are entitled. In 1879 the number of these valuable men thus entirely lost to the Service was 684 ; in 1880 it was 516.

The following extract from the annual Returns for 1880 is interesting as showing the gain and loss of the corps of Officers during that period :—

Gain.	Loss.
1,034 cadets serving in the ranks, appointed Officers.	Total loss from all causes 3,354
635 cadets joined direct from mili- tary schools.	
139 retired Officers rejoined.	
<hr/> 1,808 total gain.	Net loss 1,546

Consequently the 36,414 Officers on the establishment on the 1st January, 1880, were reduced to 34,606 on January 1, 1881. But the establishment had meanwhile been reduced to 35,493 ; the actual deficiency, therefore, amounted to 887. But as a further reduction in the establishment of Officers has been made during the year 1881, particularly in the departments and

staff, it is probable that this deficiency has been converted into a small surplus.

The following table shows the number of Officers and of officials employed in the various staffs and departments of the Army in 1862 and in 1881 :—

	1862.		1881.	
	Officers.	Officials.	Officers.	Officials.
I. War Ministry.....	518	1,057	560	706
	1,575		1,266	
II. Military District Staffs.....	1,239	2,963	1,284	1,606
	4,202		2,890	
III. Subordinate Departments.....	2,347	3,169	3,266	3,797
	5,516		7,063	
IV. Army Staff Departments.....	4,104	9,159	5,110	9,247
	13,263		14,357	

The Officers in 1881 under heading IV (5,110) are included in the total number of 34,606 effective Officers before shown as on the strength of the Army in that year.

It will be seen by the foregoing that there were in 1881, 2,012 more Officers and 992 fewer officials in all the various staffs, offices, and departments than in 1862.

Non-commissioned Officers and Men.

Pay is reckoned by the year, and the amount is handed over quarterly in arrear by the commander of the company, squadron, or battery in presence of the other Officers and of the serjeant-major. The rates of pay differ in the different arms.

The following table shows the daily pay of the infantry both in the Guard and in the line :—¹

	Guard.				Line.			
				d.				d.
Sergeant-Major	3 $\frac{3}{4}$	....	2 $\frac{1}{2}$		
Sergeant	1 $\frac{3}{4}$	....	1 $\frac{1}{2}$		
Corporal	1 $\frac{1}{4}$	....	1 $\frac{1}{4}$		
Lance-corporal	1 $\frac{1}{8}$	....	1 $\frac{1}{8}$		
Privates	1 $\frac{1}{9}$	....	1 $\frac{1}{4}$		

In time of war, on the march, and during manœuvres, these rates are increased by 50 per cent.

Instead of the rations of fresh meat and brandy formerly issued, both in peace and war, soldiers receive now a mess allowance graduated according to the market prices of the garrison towns, and ranging between 1 $\frac{3}{8}$ d. and 1d. a day for each man. This allowance is calculated to provide each man with 1 lb. of meat on 196 days of the year, the remaining 169 days being fast days.

The men get two warm meals a day, at noon and in the evening.

Certain rations are also issued in kind daily, namely, flour, 2·09 lbs., peeled barley, 0·23 lb., and salt, 0·05 lb. The men bake for themselves, and the daily ration is calculated to make 2·73 lbs. of bread or 1·67 lbs. of biscuit.

¹ Such are the rates of pay according to regulations, but it is said that practically the only coin which finds its way into the soldier's pocket is the rouble which the superior orders for each man after an inspection, and money made in harvest time."

This quantity is, however, not really baked, a large proportion of the flour is sold and other articles are bought for the benefit of the mess.

Besides the bread a liquor called "Kvas" is prepared from the flour and leaven to be drunk at meal times. Every regiment or detachment is required to have on hand eight days' supply of biscuit, which is renewed every month. In case of a march five days' biscuit is carried in the regimental wagons, and three days' supply by the men. Salt meat is not used, but on the march meat is bought in the villages, or cattle are driven along with the troops. The company mess is in charge of an "Artelshtchick," who purchases provisions for it. He is elected by the privates out of their own number, and remains in office for six months.

The Guards and some other regiments have kitchen gardens. As before noticed, it is the custom to allow as many men as possible to go out to work for wages towards the end of summer. The company commander looks out for work for his men, and sees to their being properly fed; while thus employed, of the money they earn, one-third goes to the company's mess fund, one-third to the workmen, and one-third is divided amongst the whole company. In war time the scale of rations is as follows:—

Black bread, 1·8 lbs., fresh meat, when issued, 0·3 lb., or ham, 0·226 lb., spirits, 0·27 pint. Fire and light are issued to troops in barracks.

There is a summer scale and a winter scale, the length of time for which the latter is allowed depending on the latitude of the place, the Empire being divided into three zones for this purpose. The winter scale applies to the northern zone for seven months, to the central zone for six months, and to the southern zone for five months; lights are only issued in winter. Barrack accommodation is by no means generally provided, but is being extended. In many towns troops are permanently billeted on the inhabitants, who receive sums varying from 2*l.* 7*s.* 6*d.* to 15*s.* 10*d.* a year per man billeted according to local prices. The rate per troop horse is 9*s.* 6*d.* per stall per annum. In time of war and in peace-time, when troops are on the line of march, they are supplied by the inhabitants on whom they are billeted with quarters, light, fuel, heating and cooking gratis.

Forage for Government horses is issued every ten or fifteen days. The daily ration in peace-time is as follows:—

	Oats.	Hay.	Straw.
	Pecks.	Lbs.	Lbs.
Cuirassiers.....	1·35	9·03	5·31
Other cavalry.....	1·35	9·03	2·47
Artillery (riding horses).....	1·06	9·03	2·47
„ (draught).....	1·06	9·03	2·47
Train.....	0·76	18·06	

Such is the ration for eleven months of the year; for one month hay only is issued to cavalry and artillery, the daily allowance being 15 lbs. As we have already noticed also it is customary to turn the horses out to grass some time in the autumn. This is an alternative to the large rations of hay which is otherwise given at that period.¹

¹ Commanding Officers draw the allowance for fuel, light, forage, and for purchase of horses, and make their own arrangements. In some cases Generals of Divisions seem to administer those funds themselves instead of allowing Commanding Officers to do so, which appears to be a mischievous interference with the responsibility of the latter.

Foraging on an extensive scale is carried on in war-time to eke out the grain rations for three days, which is carried in the intendance wagons.

Pensions for Non-commissioned Officers and Men.

Since the introduction of short service, pensions are only granted to men who have been wounded, or who have contracted disease in the Service. These men receive three roubles a month, this amount being doubled if an attendant is required. Assistance is likewise given by Government to families of men killed in action. The municipal authorities assist the families of reserve men who are drafted into the field army. Lastly, the Committee for aiding the wounded gives pensions, procures admission to the Cheshman and Ismailoff hospitals, and obtains fitting employment for the maimed and wounded.

The Maintenance of Discipline.

Minor offences committed by non-commissioned officers and privates may be punished summarily by all in authority, from the corporal upwards, according to a fixed ascending scale, the punishments for privates being reprimands; confinement to barracks; extra fatigues and other duties, not exceeding eight days; confinement to the guard-room, for a period not exceeding one month, spirits, tobacco, and conversation with comrades being forbidden; solitary confinement on bread and water, limited to twenty days, on every third day of which the ordinary ration is allowed; solitary confinement in a dark cell, limited to eight days; one month's imprisonment on bread and water, of which two periods each of eight days, with an intervening period of the same duration, may be passed in a dark cell in solitary confinement. Such is the nature of the summary punishments. The amount which may be awarded by the different ranks ranges between one day's confinement to barracks or one extra duty, which it is within the competence of a corporal to inflict, and the maximum award which the commander of a regiment of cavalry or infantry, of a brigade of artillery or sappers, and of a detached or independent battalion may impose. Non-commissioned officers must at once report to their superiors any punishment which they have inflicted. When men have been reduced to the second class by sentence of court-martial, they are liable to corporal punishment up to fifteen lashes when awarded by the commander of a company, squadron, or half-battery; up to twenty-five lashes by the commander of a battalion, of a wing (two squadrons), or of a battery; up to fifty lashes by the commander of a regiment of cavalry or infantry, of a brigade of artillery or sappers, of a detached or independent battalion.

Sergeant-majors and re-engaged non-commissioned officers are liable to reprimand, suspension for three months or reduction, but not to imprisonment on bread and water. Other non-commissioned officers are liable to the same punishments as privates, except corporal punishment, extra fatigues, and dark cells; they may also be reduced in rank, either temporarily or permanently, or sentenced to common arrest or to arrest on bread and water.

Temporary reduction to the ranks and reduction to a lower grade of non-commissioned rank cannot be inflicted by any Officer below the rank of regimental commander or corresponding to it; permanent reduction to the ranks cannot be awarded by any Officer below the rank of Divisional General. When on the line of march, the infantry or artillery soldier who misconducts himself may, in lieu of being sentenced to arrest, be ordered to stand under arms for some hours in full marching order, and the cavalry man may, under the same circumstances, be ordered to march behind a baggage-wagon, carrying his whole kit and accoutrements.

Officers are also liable to the following summary punishments: reprimands,

either private, in presence of the other Officers of the corps, or published in orders; extra turns of duty; confinement to quarters; arrest in the main-guard or in some place set apart for the purpose, with or without a sentry at the door; suspension from command; stoppage of promotion. Sub-Ensigns and Sub-Cornets are subject to the same punishments as commissioned Officers.

No Officer under the rank of commander of a company, squadron, or battery may punish a commissioned Officer. Officers of the rank above mentioned may inflict verbal or written reprimands, two extra duties, or one day's confinement to quarters.

The powers increase with the rank of the Officer awarding punishment until we arrive at the General in command of a military district, who may inflict one month's confinement to quarters or to the main-guard on all field or company Officers; suspension from command on Generals, regimental commanding Officers, and all officials during war; and the same during peace with the sanction of the Emperor.

Courts-Martial

The Military Code of 1872 regulates the composition and proceedings of courts-martial, and indeed all matters relating to military justice. Before 1879 all trials were conducted with closed doors, but since that time, as a general rule, the courts are open, and the proceedings are published, although in certain instances, latterly of somewhat frequent occurrence, this rule has been departed from, and the old system of privacy reverted to for political reasons. The new system, now under trial for about fourteen years, is generally approved of, though there are not wanting Officers of the old school who condemn the system of publicity as detrimental to discipline, and who think that the courts err on the side of leniency.

Every body of troops whose commander exercises the power of a regimental commanding Officer has its regimental court, and every military district has its district court at the district headquarters. There is further the Supreme Court at St. Petersburg, at which appeals from the verdicts of the lower courts are tried. The procedure is as follows: any Officer in independent command may assemble a court of enquiry to investigate any charge brought against any individual under his command, and should the offender be below the rank of commissioned Officer he may send the case on for trial. Should the accused be a field or company Officer, this right, however, belongs to the General commanding the Division; if a General, to the Supreme Court; if a General commanding a district, to the Minister of War; if a General commanding an army, to the Emperor. Charges against non-commissioned officers and privates may, moreover, be investigated by a civil or a military *procurator*, the result being laid before the commanding Officer of the corps to which the accused belongs. If the said commanding Officer should take no action in the matter, it is the duty of the *procurator* to report to the Supreme Court. A *procurator* may not institute an enquiry against an Officer without the sanction of the competent military authority. In all cases the proceedings of a court of enquiry, whether convened by a commanding Officer or by a civil procurator, are submitted to a military procurator, who attaches to them his opinion as to whether the case should be sent for trial or not. In the case of a non-commissioned officer or private the commanding Officer may act against the opinion of the procurator if he remands the accused for trial, but if the procurator is in favour of that course, and the commanding Officer differs from him, the matter must be referred to higher authority, the ultimate decision resting with the Supreme Court.

The substance of the preliminary enquiry must be communicated to the accused at least seven days before the trial.

Regimental Courts.

President, a Field Officer; members, two company Officers. A Judge-Advocate assists.

The Officer commanding the regiment, or equivalent corps, appoints the president for one year, the members for six months. The Judge-Advocate may hold his appointment for two years. Regimental Staff Officers are not eligible to serve on these courts, nor Officers who have served less than two years. The names of Officers selected for the duty are submitted to the Divisional General, who has the right of veto. Regimental courts may try all cases which do not concern any civilian and where conviction does not entail loss of privilege, service in disciplinary battalions, or fines over 100 roubles.

Procedure.

The accused may conduct his own defence or may be defended by counsel, military or civilian. The president of the court conducts the proceedings. The judge, prisoner, and prosecutor may cross-examine witnesses. When all evidence is taken, the prisoner is at liberty to make a statement, after which the court retires with the Judge-Advocate to consider their verdict. The president puts the two following questions:—1. Guilty or not guilty? 2. (If guilty) What punishment is to be awarded? The majority decide; in case of equality of votes the prisoner gets the benefit. The youngest member votes first. The verdict is signed by all the judges and is at once communicated in court to the prisoner, who has the right of appeal within twenty-four hours. The verdict must also be submitted to the Officer who convened the court within three days. He may confirm it, send the case up to a higher court, increase or reduce the amount of punishment within the limits provided by law. Should the prisoner appeal, he is allowed seven days for drawing up his case, which is then sent to the higher court for decision.

Military District Courts.

Composed of temporary and permanent members, the former selected from regimental Officers by the General commanding and serving for six months. President, a General or Colonel; permanent members, 2 Field Officers and 2 military procurators; temporary members, 2 Field Officers and 4 company Officers. Total, 11 Officers. Officers of less than eight years' service or who belong to the special arms or to the staff are ineligible as temporary members.

The district court may try all cases beyond the competency of a regimental court, and may hear appeals from the latter. The procedure is the same as in the lower court.

The Supreme Court at St. Petersburg.

This is the court of appeal, the decisions of which are final. It consists of a president and four members, all Generals or other high military functionaries specially selected. The Judge Advocate General is attached to this court.

The sentences are either "capital" or "correctional." Capital sentences on all ranks are death by hanging or shooting.

Hard labour in the mines for life or for not less than 20 years.

Hard labour with dismissal from the Service.

Hard labour in a fortress for 8 to 12 years.

Hard labour in a manufacturing establishment for 4 to 8 years.

Exile to Siberia.

Sentences.

The sentence of death is now often commuted to loss of civil rights with hard labour for life or for a certain period. The correctional punishments

which may be inflicted on Officers and officials are : Exile to Siberia, with, as a rule, loss of civil rights ; confinement in a fortress for from 2 months to 4 years ; imprisonment in a penitentiary with degradation ; simple imprisonment. Should the offence not be serious enough to entail dismissal from the Service, the culprit may be sentenced to confinement in the guard-room with suspension for 3 to 6 months, or without suspension for 1 to 3 months. Fines : permanent dismissal with or without loss of rank and decorations ; reduction to the ranks with the possibility of reinstatement ; compulsory retirement for 3 years. Non-commissioned officers and men who enjoy certain privileges in consequence of previous good service are subject to the same punishment as Officers as far as applicable ; those who do not enjoy any special privilege may be sent to a civil house of correction for 1 to 4 years, or to a workshop for from 2 months to 2 years, after which they are dismissed the Service.

Lastly, all non-commissioned officers and men are liable to removal to a disciplinary battalion for 1 to 3 years with partial loss of privileges, and to be placed in the second class when they are amenable to corporal punishment ; to solitary confinement in military cells for 1 to 14 months ; to fines with the alternative of imprisonment. Men who wear decorations or good conduct stripes can only be reduced to the second class by sentence of a district court-martial, other soldiers by that of a regimental court. Continued good conduct or distinguished conduct in the field may lead to a remission of this penalty. The chief offences in the Russian Army are theft and other dishonest practices, desertion, drunkenness, and insubordination.

Courts of Honour.

These are quite of modern origin, and are convened by regimental commanding Officers for the trial of Officers, cadets, and officials accused of unbecoming conduct. The number of members is seven with a regiment, and five with a detached battalion, a brigade of artillery, &c. They are elected annually by the corps of Officers, and must be above the rank of Lieutenant. There is a preliminary enquiry instituted by the president, or by order of the commanding Officer. The court may acquit the prisoner, reprimand him, or recommend his dismissal. The accused has no appeal except on account of want of form. Should his objection be held valid, the commanding Officer may order another court to assemble. If an Officer sentenced to dismissal has served his full time, he is compulsorily retired ; if not, he is transferred to the reserve.

Military Prisons.

These are three in number, at St. Petersburg, Moscow, and Warsaw. Each has a staff of 34 of all ranks, and cells for 200 prisoners. There are also houses of detention at Tobolsk and Oust-Kamensgorsk, where altogether 800 prisoners condemned to exile in Siberia are received. The civil prisons of various kinds are also largely used for military offenders.

Supply of Horses.

A horse census is taken periodically in European Russia, usually every sixth year. In 1878 the number of horses in the whole of that part of the Empire, excluding the Caucasus, was 17,785,975. Mulhall estimates the total number of horses in Russia (including, we presume, the Asiatic provinces, at 20,000,000 in 1878, an increase of 25 per cent. over the numbers returned in 1848 (see "Progress of the World," p. 374) ; whilst M. Grebentshikoff, who is quoted at page 160 of "Armed Strength," puts the number in European Russia at 16,354,000. The same writer estimates that out of this large number, not more than 11,184,000 are fit for work, and makes out that the latter quantity is 155,196 below the number required to supply the ordinary

wants of the country, including the peace establishment of the Army, which he reckons at 80,000. Russia is, however, fortunate in being able to supplement the European supply of horses from the excellent breeds to be found in some of her settled Asiatic provinces, not to mention her latest acquisition, the Turcoman steppes, where a large supply of hardy and enduring animals is available, a supply probably not reckoned in any of the estimates above given. There can be no doubt that though none of these estimates are probably strictly accurate, the resources of the Empire in horseflesh are enormous, including a large proportion of animals fit for every description of military purpose, and, moreover, that great attention is being paid to the improvement of the ordinary Russian horse by introducing fresh blood from the steppes and from foreign countries. We will now describe briefly the system in force for supplying the Army with horses both in peace and war.

Remounts.

As already noticed, Officers are told off in each cavalry regiment to perform all duties connected with this matter. Horses are cast annually by a Commission composed of the divisional, brigade, and regimental commanders. Those which have served 12 years are first cast; after which all animals whose service ranges between 9 and 11 years are examined as well as those of shorter service reputed unfit for work from disease or other cause. The annual allowance of remounts is calculated at 9 per cent. of the establishment. The horses purchased are collected in remount depôts. The prices paid are as follows:—

Cuirassiers of the Guard	....	....	....	....	£	s.
					47	11
Light cavalry, horse and field artillery of the Guard	....				32	0
					to	
					32	16
Ammunition teams of the Guard	....	....	....	....	19	6
Cavalry, field and horse artillery of the line	....	....	....	....	19	6
Ammunition teams of the line	....	....	....	....	15	9

		Height. Hands.	Age.	
Cuirassiers	....	15'1 to 16	4 to 7	} with a margin of 1" in height for particularly well-shaped animals.
Light cavalry of the Guard	....	14'3 „ 15'1	4 „ 7	
Cavalry of the line	....	14'2 „ 15'1	4 „ 6	
Artillery of the Guard	....	14'3 „ 15'1	4 „ 7	
„ line—				
Riding	....	14'1 „ 15'1	4 „ 6	
Draught for guns	....	13'3½ „ 15'1	4 „ 7	
„ for wagons	....	13'3½ „ 14'3	4 „ 7	
Horse artillery—				
Riding	....	14'1 „ 15	4 „ 6	
Draught	....	14'1 „ 15	4 „ 7	

The horses of the engineers, except those of the regimental train, are classed as artillery horses, as we have seen, but few are maintained in peace. Grey horses are only allowed for trumpeters of all corps, and in the lancers and hussars. Artillery horses are all dark. Not more than one-third of the total number may be mares. Stallions are never taken.

Remount horses are trained at the dépôt for a year, and are then handed over to the regiment. Officers' first chargers are, since September, 1881, supplied by the State, a regulation which will doubtless modify, but we know not to what extent, the old system under which Officers were allowed to

purchase horses from the ranks under certain restrictions at 3 guineas above the cost price, the amount being paid into the "Officer's remount fund," from which an Officer can borrow at 4 per cent. for the purchase of a remount. As already mentioned, a money allowance is made to an Officer at the beginning of a campaign for every additional charger he has to procure.

Requisitioning of Horses on Mobilization.

This is governed by a law passed in 1876, and applicable to the whole of European Russia, Poland, and the Caucasus, some districts being excepted. The main provisions are as follows: the Minister of War determines from the results of the census the number of horses to be furnished by each district. Certain points of assembly are appointed in each district to which owners must bring their horses on certain specified days. The price to be paid for each horse in each district is fixed beforehand by the Minister of War.

Owners who part with their horses voluntarily receive 20 per cent. in addition, besides thereby freeing two horses in the class to which the one taken belongs. There are penalties for attempting to elude the law. Horses were requisitioned in 30 governments at the commencement of the last war with Turkey; and, out of 69,906 animals required, 59,000 were parted with voluntarily. Including the Cossack forces, the number of horses in the Russian Army at the beginning of 1876 amounted to 126,426; and at the end of the war the number had increased to 383,890. It is stated that no difficulty was experienced in obtaining the number required, though the expenditure of horseflesh must have been enormous.

Mobilization.

Constituted as are now the armies of the great European Powers, there is probably no branch of administration of such vital importance to them as that which deals with mobilization.

Everything connected with the operation must be thought out and prepared most carefully beforehand. There can be no fixed rule as to procedure which will apply equally to all countries; on the contrary, the course to be adopted will vary according to the geographical, political, and social condition of each State. After all, however carefully everything may be provided for beforehand, each time a great army is mobilized, defects more or less great in the system will be revealed. If those in supreme authority be wise, they will at once take advantage of the experience thus gained to correct any errors, remembering that the fate of a campaign, and indeed of an empire, may depend upon the exactitude and rapidity of the process of mobilization.

Of all the great States, the German Empire is situated in the most advantageous manner, politically, socially, and geographically, for carrying out the work of mobilization with rapidity and order, and with the least possible disturbance to the cohesion of the different military bodies.

German administrators have made a most skilful use of their fortunate position, and have little by little worked out a system which leaves apparently no great room for improvement. All the nations which have followed the example of Germany in adopting the system of short service and general liability have more or less imitated the German process of mobilization, but not one of them has been able to adopt a custom which is almost universally prevalent in Germany and which contributes materially to the successful result of that process, viz., the custom of quartering corps permanently in the districts which supply them with recruits, and whence, on mobilization, reserve men return to the regiment—as a rule, to the companies, squadrons, and batteries in which they formerly served. The advantages of this custom are manifest, but, owing to various circumstances, neither France, Italy,

Austria nor Russia have been able to adopt it fully, and consequently each of these States is exposed to greater difficulties than Germany when called upon to mobilize its forces. In no country are these difficulties so great on the whole as in Russia; and, though we alluded to them briefly at the commencement of the first part of this article, it will be necessary to notice them in this place, more particularly as affecting the question of mobilization.

The special hindrances to this process in Russia arise:—1. From the vast extent of the Empire; 2. The want of a complete system of communications—a defect which will, however, in course of time be assuredly to a great extent remedied; 3. The unequal distribution of the population, the paucity of inhabitants in some extensive provinces rendering them unequal to the task of furnishing a number of men at all in proportion to their area; 4. The necessity for political and strategical reasons of concentrating an otherwise unduly large proportion of the military forces in the neighbourhood of the western and south-western frontiers. If the accompanying map and tables be consulted, it will be seen that comparatively large masses occupy the districts of Kijew, Odessa, Charkow, Warsaw, and Wilna, whilst troops are only thinly scattered over the rest of the European provinces, except at St. Petersburg, Moscow, and Kasan, all of which places are important military centres.¹ Two evils arise from this distribution of the Army, which is rendered necessary by circumstances: firstly, that many of the corps cannot be recruited in the districts which they occupy in peace-time, and that in consequence of their depôts being in the central or in the eastern provinces of the Empire, at distances ranging up to 1,000 and more English miles, their recruits have far to travel in order to join them; secondly, that in case of sudden mobilization (and mobilization will generally be sudden) it is impossible to allow the corps in question to wait for the reserve men from their own recruiting districts, and it will be necessary to complete them from the districts which they occupy, so that the great advantage derived from reserve men rejoining the bodies in which they formerly served will be lost. These remarks refer to the infantry, for the cavalry are, setting aside the Cossacks, chiefly recruited in the south-western provinces, whilst the Guard and the special arms, as we have already noticed when treating of the conscription, are drawn from all parts of the Empire promiscuously.

Again, from motives of policy, the reasons for which are apparent, there are certain considerable portions of the Empire which are not assigned as recruiting districts for special regiments, the men drawn from them being scattered throughout the Army. Thus, in ordinary times a Russian regiment is said to consist of from 75 to 80 per cent. of pure Russians, the balance being made up of Poles, Germans, Fins, Tartars, Jews, &c. The official Returns for 1880 show the numbers belonging to the different races enrolled that year to have been as follows:—Russians, 172,084, Poles, 16,657; Tartars, 4,542; Lithuanians, 6,738; Jews, 10,003; Fins, 3,218; Germans, 3,347; Mordra, 1,968; minor tribes, 13,120. The 22 local brigade districts into which, as stated in our remarks upon “Army Corps” in the first part of this article, the Empire is divided for *recruiting purposes*, are subdivided into subdistricts of unequal size, 528 in number, each of which is under a military officer, who presides over a Commission for recruiting and depôts. The subdistricts are again split into sections, in greater or smaller numbers, according to the dimensions and population of the subdistrict; each section containing in the country from 8,000 to 20,000 males, and as many as 40,000 in the towns. Each section has its rendezvous; the situation of the stations being so fixed that no recruit or reserve man has more than 40 miles to travel when required to turn out.

¹ The map is a reprint (by permission) from one of those in “Armed Strength;” the tables are founded upon those given in that work.

The men are called out by Imperial order, either in whole or in part, according to requirement. Each general government receives the order for service, containing the number, arm, rank, and class of men to be called, the rendezvous and the routes. The General Governors conduct the mobilization with the assistance of the police and taxgatherers, and of the local military authorities. Officers are told off in peace-time to superintend the conveyance of the men from the rendezvous to their corps, which are always bound to report to Divisional headquarters the number of men required to complete their establishment, thus enabling the General to distribute to corps under his command the proper proportion of the Divisional quota assigned him by the chief of the district in which the Division is quartered. Every man must be summoned personally, as but few can read a printed notice, and must then report himself within the appointed time (48 hours) at the nearest police office, whence he is passed on to the rendezvous, at the public expense, if possible by railway or steamer, if not, by road, a one-horse carriage being allowed for three men. On arrival at the rendezvous the men are medically inspected, and, when necessary, furnished with sufficient clothing, formed into detachments, and forwarded without delay to their respective corps. When a detachment is at least 200 strong, it is placed under a non-commissioned officer; if 750 strong, under an Officer; if 1,000 strong, under two Officers. Since 1870, all stores required for reserve men on rejoining the colours are kept at the headquarters of corps and ready for immediate issue, so that the men can be fitted out in every way on arrival.

Reserve Officers when called out for service are allowed five days to arrange their affairs and to equip themselves, unless employed in any civil capacity, in which case they are allowed three days extra. They must travel in the speediest way to their destination, making at least 200 miles a-day by rail or from 30 to 45 miles by road.

If all arrangements are carried out according to the programme, or fairly approximating to it, the mobilization becomes a simple and speedy process as far as the *personnel* is concerned, particularly as the cavalry and horse artillery whose services are first required are kept at all times almost on a war footing as far as men, horses, and guns are concerned; but a great deal more has to be done before the different corps are ready for service. Horses have to be provided for the regimental transport, for the field artillery augmentation, for the various trains, &c., only a small number of animals being maintained for these services in peace-time. Thanks to the law passed in 1876, it is believed that the necessary supply will always be obtainable at short notice. Then again eight days' biscuit has to be baked, a work which is said to require at least fourteen days. Side-arms must be ground, for in Russia it is customary to keep them in a blunt state until the order for mobilization is issued. It is said that in 1876 each infantry regiment required six days to prepare its spare arms for service. Reserve cartridges must also be greased, an operation which on the same occasion is reported to have taken ten days. But it can hardly be imagined that these latter hindrances to rapidity of mobilization, mere relics of an obsolete system, will be allowed to continue.

The mobilization of 1876 is our only guide as to the rapidity with which this operation can be performed in Russia, and there is every reason to expect that on the next occasion it will be carried out with greater expedition, always supposing the war to be generally popular as was that against Turkey. On the 13th November a partial mobilization, affecting fifty-two governments and provinces, was determined upon, the orders for the same being despatched by telegraph, and the 14th November being named as the first day. In one town (Nishni Novgorod) the men were all assembled on the night of the 13th, in seven other towns on the following day. In the government of Smolensk the reserve men had all joined the colours on the second day, in five governments on the third day, in twelve on the fourth, in four on the fifth, in seventeen

between the sixth and seventh, in two on the eleventh, in three on the thirteenth, in two on the seventeenth.

The men came in willingly, and the late arrival of some of the contingents was partly due to bad weather and bad roads. The whole of the horses required were delivered before fifteen days had elapsed. In fourteen days at east, in twenty-one days at most, every corps told off for the army of operations was ready to take the field, and on the 10th December the first despatch of troops to Bessarabia took place. The mobilization and concentration of the army, which at first only consisted of 180,000 men, required about seven weeks.

The experience gained in 1876 does not seem to have borne good fruit if we may consider the following example of the mobilization of a field artillery brigade belonging to the Guard and stationed at Warsaw, quoted by Lieutenant v. Drygalski from the "Russian Artillery Journal" of January, 1882, as a fair sample of the manner in which corps were mobilized in 1877. The order for mobilizing the Imperial Guard was issued on the 22nd July, 1877, but had been expected for a long time, so that there had been ample opportunity to make arrangements in anticipation, a course which was indeed pursued by the local military authorities. The reserve men of the brigade in question began to come in on the fourth day, the extra horses on the eleventh day. There were thirty-three Officers above the establishment on the strength of the brigade, and though they were not all present, there were still some supernumeraries; 661 men, or about one-third of the war establishment of 1885, were wanting. According to the programme prepared long before, the brigade should have been complete on the fifteenth day, but instead of this 8 per cent. were then still deficient, and men kept coming in till the thirty-fourth day. At first it was intended to put men back into the batteries to which they had formerly belonged, but this could only be done to a small extent, for amongst the reserve men forwarded to the brigade were many old cavalry and infantry soldiers with whom, particularly with the latter, it was difficult to know what to do. Eventually, however, by judicious private arrangement between commanding Officers of the different arms, this difficulty was to a great extent overcome, and only two infantry men per battery were left. 958 additional horses were required, which, according to programme, should all have been delivered by the seventh day, but were really not complete till the thirteenth day, which is not to be wondered at seeing that they had to be collected from Petersburg, Shitomir, Staro-Konstantinow, Wladimir in Volhynia, and Lipno. When received they proved to be of very different shapes and sizes, and in consequence were not put together at all satisfactorily till the end of the third week. As regards the *matériel*, there was no hitch of any consequence, although the guns in use were changed at the last moment or those of the new pattern. But 45 per cent. of the complement of drivers, together sixty men per battery, had to be taught how to ride during the process of mobilization. On the 17th August, the twenty-seventh of mobilization, the batteries were for the first time able to turn out fit for service. They were inspected on the 21st, on the 23rd they marched out for exercise, and on the 24th had some target practice. They left Warsaw in twelve trains, to each half-battery a train of thirty carriages, between the 26th August and the 2nd September. The journey to the Roumanian frontier took about seven days, and the whole distance to Frateschti on the Danube was performed in ten days, so that the brigade was not assembled at its point of destination till the fifty-second day after the order for mobilization was issued.

A war against both, or even against one, of the great Central European Powers would require from the very first a much greater display of force than was judged necessary at the commencement of the Turkish War; it would probably be nearer the numbers under arms at the date of the Treaty of Berlin than those shown on paper after the first partial mobilization of

1876¹: hence the time required for getting the army ready for action would be doubtless considerably greater than on that occasion; still, allowance must be made for the greater carrying powers of the lines leading to the western frontier; for the fact that seven or eight Army Corps are permanently stationed in the military districts—Wilna, Warsaw, and Kijew—as well as a large proportion of the cavalry and horse artillery, eight and a-half Divisions, comprising 140 squadrons, in the districts of Wilna and Warsaw; and also for the probability that before the next war great improvements will be made in the machinery for mobilization.

But it is not only the corps of the field army which have to be considered; the establishment of each of these has, at the outside, to be doubled, and their situation is in other respects comparatively favourable; whereas the reserve Divisions, which have also to be prepared for war, are in a very different plight. As regards the infantry, the numbers have to be increased tenfold; in the case of the artillery eightfold, both as to men and *matériel*. Moreover, to add to the difficulties, nearly half the reserve battalions are in the western districts (twenty-eight in those of Warsaw and Wilna), and distributed by companies (see table with map). However, a simultaneous mobilization of the reserves and *depôt* troops, as well as of the field army, is never likely to be required. Reserve battalions and batteries will doubtless be mobilized by degrees, those on the western frontier being employed for garrison duties, whilst a reserve army will be formed from the remainder and from the Cossacks of the 2nd and 3rd categories at some central station.

Fortresses.

On the northern shore of the Gulf of Finland:—

Sweaborg, 1st class.		Viborg, 2nd class.
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On the southern shore of the Gulf of Finland and on the Baltic:—

1st class.	2nd class.	Of minor importance.
Kronstadt.	Dünamünd. Dünaburg.	Revel. Koberschanz.

On the Polish frontier:—

Novo-Georgievsk. Brest-Litevsk.	The Alexander citadel at Warsaw. Ivangorod. Bobruisk.	Zamosc.
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From extremity of Polish frontier to the Black Sea:—

Kijew.		Lutsk. Bender.
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On the Black Sea:—

Kertch.		Nicholaiev. Odessa. Sevastopol.
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In the Caucasus:—

Kars. Alexandropol.		Ardahan. Akhaltzikh. Erivan. Shusha.
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Also a number of mountain forts.

¹ Before the war broke out Russia had under arms 857,376 Officers and men, including Cossacks. On 1st January, 1877, this number was raised to 1,192,678; at the close of 1877 the army amounted to 1,638,395; and at the date of the Treaty of Berlin (July, 1878), to 1,831,617.

MAP OF EUROPEAN RUSSIA

SHOWING MILITARY DISTRICTS & HEAD QUARTERS OF ARMY CORPS.

Journal of U.S. Institution.
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At Krasnovodsk in the Trans-Caspian district there is a small fort. In Turkestan and its dependencies there are forts at Petro-Alexandrovsk the Oxus, at Petrosk in the Kirghiz Steppe, at Viernoié (in Sémerechia). In Siberia, there are forts at Omsk, on the River Irtysh, at Semi-Palabinsk, K-Kamensgovsk, and at Bukhtarminsk; on the Chinese frontier at Oitkosavsk and on the Pacific the fortified ports of Nicholaievsk and of Adivostok.

It has been determined to construct new forts at Warsaw, Kowno, and at Mivoz (in the Grodno district), at a total cost of 60,000,000 roubles, spread over a period of ten years.

The works at Warsaw were commenced last year (1882). Seven detached forts will be constructed on the left bank of the Vistula, at nearly 4 miles distance from the city and extending along a front of about 17 miles. Four more forts will be constructed over a mile from the former line, and again on the other side of the river at 4 miles from Praga there will be a line of four large works.

For a sketch of the whole system of Russian defences on the western frontier, see "The Russo-German Frontier in 1880," in No. CIV of this Journal, and "A Study of Operations in the Polish Theatre of War," in No. CXII of this Journal.

A.—Numerical Strength of the Russian Army, 1883.

EUROPE.

Corps.	Peace.				War.				Remarks.	
	Com- batants.	Non- com- batants.	Total Men.	Horses.	Guns.	Com- batants.	Non- com- batants.	Total Men.		Horses.	Guns.
<i>Field Troops.</i>										
Staff of 17 Army Corps . . .	272	595	867	..	..	272	595	867	—	—
41 Infantry Divisions	308,853	14,637	323,490	6,068	..	647,513	19,721	667,234	38,048	—
32 Rifle battalions	14,848	1,056	15,904	288	..	31,392	1,408	32,800	1,952	—
16 (in war 17) Cavalry Div.	52,902	5,485	58,387	46,506	..	53,464	6,043	59,507	50,382	—
41 Field artillery brigades ..	43,733	3,390	47,123	12,696	984	53,464	6,678	60,142	47,408	1,968
34 Horse artillery batteries	5,848	714	6,562	5,474	204	6,290	1,054	7,344	8,223	204
15 Sapper battalions	11,725	570	12,295	240	..	14,445	795	15,240	1,470	—
4 Railway battalions	3,848	184	4,032	116	..	4,104	184	4,288	116	—
8 Pontonier half-battalions.	2,504	160	2,664	136	..	3,192	1,512	4,704	3,168	—
5 Field engineer trains	285	30	315	5	..	650	700	1,350	1,350	—
15 Telegraph trains	1,230	45	1,275	30	..	4,530	1,110	5,640	3,015	—
4 Miner companies	520	..	520	..	..	964	..	964	—	—
4 Torpedo companies	976	92	1,068	12	..	988	92	1,080	12	—
1 Galvanic company (for instruction)	247	..	247	..	..	247	..	247	—	—
Total Field Troops	447,791	26,958	474,749	71,571	1,188	821,515	39,892	861,407	155,149	2,172

Horses of Commanding Officers and of Staff are not shown, being private property.. The 2 Guard Divisions are made into 3 in war. Cavalry and probably Horse Artillery will have above 50 per cent, added to their strength by 1889 if the augmentations contemplated are carried out. 15 Regiments and 1 squadron of Don Cossacks are included in the Cavalry Divisions. 6 Don Cossack batteries are included in the Horse Artillery.

N.B.—Headquarter, administrative, medical and educational staff, intendants trains, ammunition columns, hospital and ambulance trains, are not included in this or in the following tables, but regimental trains are included.

Corps.	Peace.					War.					Remarks.	
	Com- batants.	Non- com- batants.	Total Men.	Horses.	Guns.	Com- batants.	Non- com- batants.	Total Men.	Horses.	Guns.		
<i>Reserve Troops.</i>												
97 Reserve cadre infantry battalions	50,731	3,007	53,738	485	11,136	385,152	22,368	..	1 Lately augmented from 20 companies { 2nd and 3rd cate- gories of the field class	
24 Reserve infantry Divisions .....	..	..	..	..	..	..	..	..	..	..
6 Reserve artillery brigades	6,634	744	7,423	1,770	144	374,016	..	..	..	..
24 " " " " " " " " " "	..	..	..	..	..	20,016	1,248	21,264	15,168	763
30 Reserve engineer companies ¹, ...	..	..	..	..	..	7,230	180	7,410	510	..
40 Don Cossack cavalry regiments...	..	..	..	..	..	36,320	2,720	39,040	37,230	..
14 Don Cossack horse artillery batt.	..	..	..	..	..	2,590	434	3,024	3,388	84
Total Reserve Troops	57,415	3,751	61,166	2,255	144	440,172	15,718	455,890	78,714	852		
<i>Fortress and Depot Troops.</i>												
148 Fortress artillery companies	17,020	148	17,168	..	..	49,136	148	49,284	—	—
164 Depot infantry cadres	4,264	..	4,264	—	—	—	—	—	—	—		
164 " " battalions .....	..	..	..	..	..	186,468	4,920	191,388	1,312	—
24 Guard and Grenadier depot batt.	..	..	..	..	..	33,288	720	34,008	192	—
101 Reserve infantry depot batt. ..	..	..	..	..	..	98,475	2,323	100,798	7,878	—
7 Rifle depot battalions .....	..	..	..	..	..	7,679	206	7,885	56	—
52 Cavalry depot squadrons	10,504	2,600	13,104	6,448	..	14,664	2,600	17,264	6,448	—		
104 " provisional squadrons ..	..	..	..	..	..	26,936	1,248	28,184	18,720	—
42 Field artillery depot batteries ..	..	..	..	..	..	25,494	78	25,572	1,806	336
6 Horse artillery depot batteries...	..	..	..	..	..	5,196	108	5,304	696	48
4 Sapper depot battalions .....	..	..	..	..	..	3,896	128	4,124	—	—
Total Fortress and Depot Troops	31,788	2,748	34,536	6,448	..	451,232	12,479	463,811	37,108	384		
Grand Total, Res., Fort., & Dep. Tps.	89,203	6,499	95,702	8,703	144	891,404	28,197	919,701	115,822	1,236		
Grand Total, Field, Reserve, &c., } Corps in Europe.....	536,994	33,457	570,451	80,274	1,332	1,712,919	68,089	1,781,108	270,971	3,408		

Corps.	Peace.					War.					Remarks.
	Com- batants.	Non com- batants.	Total men.	Horses.	Guns.	Com- batants.	Non- com- batants.	Total men.	Horses.	Guns.	
Field Troops.											
Staff of 2 Army Corps	28	58	86	32	70	102	—	—	14 Regiments, of which 10 of Cos- sacks of Kuban and Terek; horse batte- ries also from thence.
7 Infantry Divisions	52,766	2,583	55,349	1,036	..	110,523	3,360	113,883	5,208	—	
10 Rifle battalions.....	4,640	330	4,970	90	..	9,810	440	10,250	610	—	
3 Cavalry Divisions.....	12,364	1,026	13,390	11,637	..	12,566	1,125	13,691	12,371	..	
7 Field artillery brigades	7,462	574	8,036	2,163	168	10,164	1,008	11,172	11,172	336	
5 Cossack horse artillery batteries..	980	120	1,100	855	30	980	155	1,135	1,285	30	
2 Sapper battalions	1,430	78	1,508	32	..	1,960	106	2,066	196	—	
1 Telegraph train	76	2	78	2	..	301	67	368	186	—	
1 Engineer field train	42	6	48	..	..	97	139	236	280	—
4 Frontier infantry battalions	1,848	180	2,028	112	..	3,912	300	4,212	392	—	
Total Field Troops	81,636	4,957	86,593	15,927	198	150,345	6,770	157,115	31,700	366	
Reserve, Fortress, and Depot Troops.											
1 Fortress infantry regiment	800	52	852	..	..	3,061	179	3,240	16	—
4 Depot infantry battalions .....	..	..	..	..	..	4,548	120	4,668	32	—
2 Plastoun battalions	1,470	134	1,604	174	..	1,426	134	1,560	174	—	
4 Cavalry depot squadrons	824	264	1,088	496	..	1,144	264	1,408	496	—	
8 Cavalry provisional squadrons ..	..	..	..	..	..	2,072	96	2,168	1,760	—
6 Irregular cavalry regiments	4,656	237	4,893	5,151	..	4,518	273	4,791	5,297	—	
16 Fortress artillery companies	2,558	22	2,580	..	..	5,162	22	5,184	..	—
4 Sapper reserve companies .....	..	..	..	..	..	960	53	1,013	98	—
2 Cossack horse artillery batteries..	310	42	352	316	8	480	62	542	604	12	
5 Cossack infantry battalions ....	..	..	..	..	..	4,265	335	4,600	435	..
30 Cossack cavalry regiments .....	..	..	..	..	..	24,140	1,580	25,720	28,000	..
Total Res., Fortress, and Depot Troops	10,618	751	11,369	6,137	8	51,776	3,118	54,894	36,912	12	
Grand Total, Caucasus and Trans- [	93,254	5,708	97,962	22,064	206	202,121	9,888	212,009	68,612	378

A. 3.—Numerical Strength of the Russian Army—continued.

TURKKESTAN.

Corps.	Peace.					War.					Remarks.
	Com- batants.	Non- com- batants.	Total Men.	Horses.	Guns.	Com- batants.	Non- com- batants.	Total Men.	Horses.	Guns.	
Staff	52	180	232	..	..	52	180	232	..	—	
4 Battalions of rifles	1,848	140	1,988	48	..	3,912	188	4,100	312	—	
18 Frontier battalions	10,674	828	11,502	324	..	18,684	1,116	19,800	1,728	—	
8 Regiments of Cossack cavalry ..	6,744	422	7,166	6,910	..	6,630	458	7,088	7,061	..	From Ural, Semiritia, and Orenburg.
2 Brigades of field artillery	1,378	176	1,554	590	36	2,013	389	2,402	1,728	64	
1 Mountain horse battery	370	46	416	322	12	440	60	500	528	12	Orenburg.
2 Batteries Cossack horse artillery	496	34	530	52	..	496	34	530	52	—	
1 Half-battalion of engineers	720	32	752	..	..	720	32	752	—	—	
4 Companies of fortress artillery ..	..	..	..	..	..	1,230	114	1,344	1,402	—	
8 Sotnias of Semiritia Cossacks, ...	22,282	1,858	24,140	8,246	48	34,177	2,571	36,748	12,811	76	
Total											

A. 4.—Numerical Strength of the Russian Army—continued.

SIBERIA.

Corps.	Peace.			War.					Remarks.		
	Com- batants.	Non- com- batants.	Total Men.	Horses.	Guns.	Com- batants.	Non- com- batants.	Total Men.		Horses.	Guns.
Staff	38	129	167	..	..	38	129	167	—	—	
4 Rifle battalions	1,848	140	1,988	48	..	3,912	188	4,100	312	—	
7 Frontier battalions	3,627	318	3,945	166	..	7,026	486	7,512	680	—	
3 Battalions of Cossack infantry	2,277	70	2,347	26	..	2,986	148	3,134	103	..	Transbaikal.
3 Regiments of Cossack cavalry	2,606	165	2,771	2,713	..	2,379	201	2,580	3,111	..	Siberian.
1 Brigade of field artillery	483	64	547	140	12	760	165	925	681	24	
Independent batteries, 1 in peace, } 2 in war	173	13	186	51	4	459	77	536	489	16	
2 Batteries of Cossack horse artillery	312	42	354	252	8	484	62	546	562	12	Transbaikal.
1 Company of engineers	244	16	260	16	..	244	16	260	16	—	
1 Company of fortress artillery	305	8	313	..	..	305	8	313	—	—	
<i>Cossacks of 2nd and 3rd Categories, Field Class.</i>											
4 Battalions of infantry .....	..	..	..	..	..	3,728	156	3,884	128	..	Transbaikal.
8 Regiments of cavalry .....	..	..	..	..	..	7,254	534	7,788	8,382	..	Transbaikal and Siberian.
1 Battery of horse artillery .....	..	..	..	..	..	242	31	273	281	6	Transbaikal.
Total	11,913	965	12,878	3,412	24	29,817	2,201	32,018	14,745	58	

RECAPITULATION.

THE RUSSIAN ARMY IN 1882.

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	Peace.					War.				
	Com- batants.	Non- com- batants.	Total Men.	Horses.	Guns.	Combatants.	Non- com- batants.	Total Men.	Horses.	Guns.
<i>Europe.</i>										
Field troops	447,791	26,958	474,749	71,565	1,188	821,515	39,892	861,407	155,149	2,172
Reserve, fortress, and depôt troops	89,203	6,499	95,702	12,703	144	891,404	28,197	919,701	115,822	1,236
Total	536,994	33,457	570,451	84,268	1,332	1,712,919	68,089	1,781,108	270,971	3,408
<i>Caucasus, &c.</i>										
Field troops	81,636	4,957	86,593	15,927	198	150,345	6,770	157,115	31,700	366
Reserve depôt, &c. ..	10,618	751	11,369	6,137	8	51,776	3,118	54,894	36,862	12
Total	92,254	5,708	97,962	22,064	206	202,121	9,888	212,009	68,562	378
<i>Turkestan.</i>										
Total	22,282	1,858	24,140	8,246	48	34,177	2,571	36,748	12,811	76
<i>Siberia.</i>										
Total	11,193	965	12,878	3,412	24	29,817	2,201	32,018	14,745	58
Grand Total in the Empire	662,723	41,988	705,431	117,990	1,610	1,979,034	82,749	2,061,883	367,089	3,920

B.—*Strength of the different Arms.*

EUROPE.

	Peace.					War.					Remarks.
	Com- batants.	Non- com- batants.	Total Men.	Horses.	Guns.	Com- batants.	Non- com- batants.	Total Men.	Horses.	Guns.	
<i>Field Troops.</i>											
Infantry	323,701	15,693	339,394	6,356	..	678,905	21,129	700,034	40,000	—	N.B.—Staff not included.
Cavalry	52,902	5,485	58,387	46,500	..	53,464	6,043	59,507	50,382	—	
Artillery	49,581	4,104	53,685	18,170	1,188	59,754	7,732	67,486	55,636	2,172	
Engineer troops	21,335	1,081	22,416	539	..	29,120	4,393	33,513	9,131	—	
Total field troops	447,519	26,363	473,882	71,565	1,188	821,243	39,297	860,540	155,149	2,172	
<i>Reserve, Fortress, and Depot Troops.</i>											
Infantry	54,995	3,007	58,002	485	..	699,926	19,305	719,231	31,806	—	
Cavalry	10,504	2,600	13,104	6,448	..	77,920	6,568	84,488	56,448	—	
Artillery	23,704	892	24,596	1,770	144	102,432	2,016	104,448	21,058	1,236	
Engineer troops .....	..	..	..	..	..	11,126	308	11,434	510	—	
Total reserve, &c., troops	89,203	6,499	95,702	8,703	144	891,404	28,197	919,601	109,822	1,236	

B. 1.—*Strength of the Different Arms—continued.*

CAUCASUS, &c.

	Peace.					War.					Remarks.
	Com- batants.	Non- com- batants.	Total Men.	Horses.	Guns.	Com- batants.	Non- com- batants.	Total Men.	Horses.	Guns.	
<i>Field Troops.</i>											
Infantry.....	59,254	3,093	62,347	1,238	..	124,245	4,100	128,345	6,210	—	
Cavalry.....	12,364	1,026	13,390	11,637	..	12,566	1,125	13,691	12,371	—	
Artillery.....	8,442	694	9,136	3,018	198	11,144	1,163	12,307	12,457	366	
Engineer troops.....	1,548	86	1,634	34	..	2,358	312	2,670	662	—	
Total field troops.....	81,608	4,899	86,507	15,927	198	150,313	6,700	157,013	31,700	366	
<i>Reserve, Fortress, and Depot Troops.</i>											
Infantry.....	2,270	186	2,456	174	..	13,300	768	14,068	657	—	
Cavalry.....	5,480	501	5,981	5,647	..	31,874	2,213	34,087	35,503	—	
Artillery.....	2,860	64	2,922	316	8	5,642	84	5,726	604	12	
Engineer troops.....	..	..	..	..	..	960	53	1,013	98	—	
Total reserves, &c.....	10,610	751	11,369	6,137	8	51,776	3,118	54,894	36,862	12	

B. 2.—*Strength of the Different Arms—continued.*

TURKESTAN.

	Peace.					War.					Remarks.
	Com- batants.	Non- com- batants.	Total Men.	Horses.	Guns.	Com- batants.	Non- com- batants.	Total Men.	Horses.	Guns.	
Infantry	12,522	968	13,490	372	..	22,596	1,304	23,900	2,040	—	N.B.—Staff included.
Cavalry	6,744	422	7,166	6,910	..	7,860	572	8,432	8,432	—	
Artillery	2,468	254	2,722	912	48	3,173	481	3,654	2,256	76	
Engineer troops.....	496	34	530	52	..	496	34	530	52	—	
Total troops	22,230	1,678	23,908	8,246	48	34,125	2,391	36,516	12,780	76	

N.B.—Staff
included.

SIBERIA.

Infantry	7,752	528	8,280	240	..	17,652	978	18,630	1,223	—
Cavalry	2,606	165	2,771	2,713	..	9,633	735	10,368	11,493	—
Artillery	1,273	127	1,400	443	24	2,250	343	2,593	2,013	58
Engineer troops.....	244	16	260	16	..	244	16	260	16	—
Total troops	11,875	836	12,711	3,412	24	29,779	2,072	31,851	14,745	58
Grand total in the whole Empire, field, reserve, fortress, depôt, and irregular	663,053	40,926	703,979	113,990	1,610	1,978,640	81,775	2,060,415	361,058	3,920

EUROPE.

District.	Corps.	Infantry.	Rifles.	Cavalry.	Field Artillery.	Horse Artillery.	Garrison Art.	Engineers.
Petersburg {	Guard	8 Regts.	3 Batts.	9 Regts., 1 squad.	2 Brigades	2 Batteries	11½ Batteries	1 Battalion
Finland	I	12 "	..	4 Regts.	3 "	2 "	—	1 Brigade
Wilna	II	12 "	1 Batt. (Guard)	..	1 "	—	—	—
	III	8 "	4 Batts.	4 Regts.	3 "	2 "	6 "	1 Brigade
	IV	8 "	..	4 "	2 "	2 "		
	Guard	4 "	..	4 "	2 "	2 "		
	V	8 "	8 Batts.	2 "	1 "	1 "		
	VI	12 "	..	4 "	2 "	2 "		
Warsaw ..	XIV	8 "	..	4 "	3 "	2 "	17 "	1 "
	..	..	..	4 Regts. Don. Coss.	2 "	2 "		1 "
Kiew	XI	8 "	..	4 Regts.	—	—		
	XII	8 "	4 Batts.	4 "	2 "	2 "	4 "	1 "
Odessa....	VII	8 "	..	4 "	2 "	2 "		
	VIII	8 "	4 Batts.	4 "	2 "	2 "	9 "	1 "
	IX	8 "	..	4 "	2 "	2 "		
Charkov ..	X	8 "	..	4 "	2 "	2 "		
	Grenadier	12 "	..	..	2 "	2 "	—	—
Moscow ..	XIII	12 "	..	4 Regts.	3 "	2 "	—	—
Kasan	XV	8 "	..	..	2 "	—	—	—

THE CAUCASUS.

Caucasus....	I Caucasus	8 Regts.	5 Batts.	5 Regts.	2 Brigades	2 Batteries	4 Batteries	1 Brigade
	II "	8 "	4 "	5 "	2 "	2 "		
	3 Independent Divs.	12 "	..	..	3 "			

Distribution of Reserve, Infantry, and Artillery, and of Cavalry Depôts.

	8 Reserves cadres battalions.	10 Depôt squad- rons (Guard)	1 Reserveartil- lery brigade.
Petersburg	{ 4	—	—
Finland.....	12	..	1
Wilna	16	—	..
Warsaw.....	8	—	—
Kiew.....	12	—	{ 1 Horseartil- lery battery.
Odessa	12	{ 6 Depôt cavalry brigades	1 Reserveartil- lery brigade.
Charkov	12	1	{ 2 1 Horseartil- lery battery.
Moscow.....	12	..	—
Kasan	12	{ 1 ..	—
Caucasus .....	..	{ (Caucasians)	—

The following corrections are required in the first and second parts of this article ; some in consequence of errors on the part of the author, some again in consequence of misprints, and others because of changes made in Russia since the first two parts were printed.

PART I.

- Page 16, note 4. For "litter" read "the latter."
Page 17, note 3. Instead of the words which follow "regiment" read "except to the Cuirassiers of the Guard, which will retain the present organization. There will thus be altogether 328 service squadrons."
Page 18. The calibre of the light field gun is 3·42-inch instead of 2·42-in., as stated.
Page 18, note 1. For "519" read "511."
Page 24. Present war footing. Total combatants 3,909 instead of 3,911, as stated.
Page 30, line 27. After "870" insert "mounted."
Page 33, line 21. For "this" read "the."
Page 38, line 11. Omit the first "the."
Page 41, line 12 from bottom. Omit "See page 237."
Page 42, line 13. For "Russian" read "Reserve."

PART II.

- Page 11. Add to the peace establishment of a heavy field battery "Volunteer 1."
For "201" read "202."
For "207" read "208."
For "236" read "237."
For "242" read "243."
Page 11, line 9 from bottom. For "172" read "173."
Page 11, line 8 from bottom. For "210" read "211."

Page 12. In the peace establishment of a horse battery—

For "28" read "40."

For "117" read "109."

Add "Volunteer 1."

For "176" read "167."

For "181" read "172."

Page 12, line 3 from bottom. For "three" read "four," for "one" read "nine,"
for "bombardier" read "bombardiers."

Page 13, line 10. For "24" read "23."

Page 13, line 12. For "15" read "21." For "26" read "31."

Add after "war," "including 1 surgeon, 1 veterinary surgeon,
1 second class riding-master."

Page 13, line 25. For "106" read "98."

Page 13, line 26. For "169" read "161."

Page 13, line 27. For "107" read "99." For "103" read "123."

Page 13, line 28. For "230" read "242."

Page 21, line 4 from bottom. After "has" insert "been."

Page 29, line 3. For "185" read "189."

Page 38, line 19. Insert "2" before "staff."

THE EXPEDITION OF VON BOLTENSTERN'S DETACHMENT
IN THE LOIR VALLEY ON THE 26TH AND 27TH DECEMBER,
1870.¹

Translated from the original by Captain J. K. TROTTER, R.A., Intelligence Branch, Quartermaster-General's Department.

Note.—The Great General Staff at Berlin have very kindly given permission for a translation of the original account to be inserted in the Journal of the Royal United Service Institution ; but on the distinct understanding that the translation is not to be issued separately in pamphlet shape, or to appear in any other form than as an integral part of the Journal.—L. A. H.

AFTER the battle of Beaugency-Cravant, and the engagements of the 15th and 16th December on the Loir, General Chanzy, by a well-timed retreat, succeeded in escaping the pursuit of the Germans. About the middle of December the 1st Army of the Loire under General Bourbaki became again the main object of the attention of his opponents. The 2nd Army of the Loire reached Le Mans, not without severe losses, indeed, but yet in some degree of order.

On the German side at this time the securing of the investment line of Paris on the south-west was in the first instance to be undertaken by the troops under the orders of the Grand Duke of Mecklenburg, which, with this object, were posted near Châtres. The Xth Army Corps with the 1st Cavalry Division, under the command of General von Voigts-Rhetz, remained in the space between the Loir and the Loire to cover the right flank of the IIInd Army, which had its main body about Orleans, to observe the army of General Chanzy from Vendôme, and to be in a position to take advantage, by a forward movement on Tours, of any successes which might be gained.

In the carrying out of his task General von Voigts-Rhetz caused General von Kraatz-Koschlau to take post with 6½ battalions, 10 squadrons and 4 batteries at Vendôme, occupied Blois with 3 battalions, 5 squadrons, 2 batteries, and himself advanced upon Tours with 15 battalions, 12 squadrons, 9 batteries and 3 pioneer companies. On the 20th December he encountered, south of Monnaie, a hostile body of 10—15,000 men, which had recently been collected under General Ferri Pisani for the protection of the town, forced it back on Langeais, and appeared on the 21st with the heads of his columns before the gates of what had hitherto been the seat of the French Provincial Government ; but withdrew again on Herbault and Blois. From these places General von Voigts-Rhetz took up once more a position of observation facing towards the west, north-west, and south-west, and, for the rest, secured for the main body of his troops here assembled the repose which was so urgently needed.

The situation of the detachment posted about Vendôme under General von Kraatz for the purpose of observing the enemy who had retreated upon Le Mans, and of maintaining communication with the Grand Duke of Mecklenburg, was less favourable. It stood in closest proximity to the main forces of the enemy, and had, moreover, to encounter many difficulties arising from the unfavourable nature of the ground.

The district north of the Loire is divided by the Loir into two parts which, in many respects, have a totally different character. Whilst south of the

¹ From "Kriegsgeschichtliche Einzelschriften." Herausgegeben vom Grossen Generalstabe Abtheilung für Kriegsgeschichte. Heft I. Berlin, 1883. See Notice in No. CXX of the Journal.

stream extend broad unbroken plains varied only by rich cultivation and numerous scattered buildings, on the north side the country forms a much intersected, wooded, hilly and undulating tract, ascending in the north to the mountains of the so-called Perche. Orchards, small patches of wood or even larger forests, intercept almost everywhere the view, and this difficulty is extraordinarily increased by numerous growing hedges. To leave the road seems frequently to be impossible. The Loir, which is passable only at the bridges, winds in and out of a sharply indented, by no means broad valley, 420 to 520 feet deep. Its banks, where the stream approaches them, slope steeply, at many points are nearly perpendicular, and almost everywhere are covered with vines.

Along this valley runs one of the main roads leading to the enemy by Les Roches, Montoire, Troo, and Sougé, whilst the other winds north of it over the high ground to Epuisay, where its distance from the first road is already about 11 miles. To a hostile population, which had taken a considerable part in the operations of minor warfare, the greatly intersected nature of the intervening country rendered it comparatively easy to keep up communication or even touch from one road to the other. To these difficulties may be added those caused by the weather. Up to December 15th it had rained, then succeeded cold weather with raw winds and snow showers which covered the roads with ice.

General von Kraatz had only some 4,000 men at his disposal. They were made up of half of the 20th Infantry Division, reinforced by two regiments of the 2nd Cavalry Brigade and two batteries of the Corps Artillery.¹

Numerous actions had, however, sensibly diminished the strength of these troops. To the bloody battles before Metz had succeeded the wearisome blockade of this fortress; the battles of Beaune la Rolande, Orléans, Beaugency-Cravant, the actions of St. Arnoud and Vendôme, and a number of smaller engagements had caused fresh heavy losses. Thus the total of the casualties incurred in action by the 39th Infantry Brigade up to the 16th December already amounted to 22 Officers and 374 men killed, and 57 Officers and 1,346 men wounded, *i.e.*, almost a third of its marching out strength. But hardships and privations had thinned the ranks even more than battles and engagements. In spite of considerable reinforcements from the Ersatz Reserve, of the troops of General von Kraatz' Detachment, the 56th Infantry Regiment numbered, in the middle of December, only 1,391 combatants, the 79th Regiment, 1,436. The position of the cavalry was somewhat more favourable, yet the 3rd Cuirassiers had, of a total strength of 534, 75 sick; the 12th Lancers, 71 sick out of 516; the 2nd Squadron of the 16th Dragoons, 40 sick and detached out of 117, the 5th Squadron only 115 effective. In general, therefore, the battalions could barely turn out against the enemy 500 bayonets, and the squadrons 70-80 sabres.

General von Kraatz, therefore, sought to fulfil his task, so far as circumstances permitted him, with all possible saving of the troops. He concentrated his detachment in and about Vendôme and continued the observation of his opponent—except in so far as the minor enterprises of outposts were concerned—by means of cavalry and flying columns. The reconnaissances of the 19th December made it clear that the country as far as Mondoubleau,

¹ 39th Infantry Brigade, 2nd and 5th Squadrons of the 16th Dragoons, 4th Heavy, 4th Light, 1st and 3rd Horse Artillery Batteries of the Xth Army Corps, 3rd Cuirassiers, 12th Lancers. Till the 20th the 10th Jäger Battalion was with Von Kraatz' Detachment; on the other hand, the 5th and 6th Companies 79th Regiment were absent acting as *Étappen* troops in Pithiviers.

On the 21st the Jäger Battalion moved off for Blois, but on the 23rd the 5th and half the 6th Company 79th Regiment reached Vendôme, the remainder of No. 6 Company being still employed as prisoners' escort.

General Map
of
PERCHE, BEAUC
and
SOLOGNE.



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St. Calais and Savigny was clear of the enemy, whilst on the other side of St. Calais a strong hostile column was observed to be marching upon Le Mans. A flying column under Major Schmidt von Knobelsdorf, consisting of 5 companies, 2 squadrons and 2 guns, which moved off towards Montoire on the 21st December, found on 22nd December that the woods and heights of Sougé were occupied by the enemy's infantry, but succeeded in restoring the broken bridges over the Loir at Les Roches and Montoire.

On the 22nd St. Calais was found to be clear of the enemy. The inhabitants said that on the 18th large masses of troops had passed through the town, but that on the 19th and 20th only small detachments had followed. On the 23rd, however, a cavalry patrol, which had been pushed forward, was received there with fire from hostile infantry and cavalry patrols, and was forced to retire with loss. On the same day Major von Schmidt returned to Vendôme.

General von Kraatz upon this gave orders for a systematic reconnaissance, and Officers' patrols were to be sent off daily in the following directions :—

1. From the 3rd Cuirassiers :—

(a.) To Oucques, with the heads as far as Villeneuve-Frouville, Marchénoir and Ecoman ;

(b.) In the direction of Cloyes as far as St. Hilaire la Gravelle ; heads as far as the first place and to the flank as far as Danzé.

2. From the 12th Lancers :—

(a.) To Épuisay ; heads as far as Mondoubleau, St. Calais and Savigny ;

(b.) To Montoire on both banks of the Loir ; heads as far as the Braye brook and flankers as far as St. Arnoult.

3. From the two Dragoon squadrons :—

(a.) To St. Arnoult, with flanking patrols as far as Château Renault and Gomerbeau ;

(b.) To Le Breuil.

The entire neighbourhood of Vendôme was in this way to be examined by sending forward a radiating system of patrols, and a connection was at the same time to be maintained with the neighbouring troops. General von Kraatz aimed also at pushing forward, as had been done before, flying columns in the direction of the enemy in order to prevent weak hostile forces from gradually gaining a footing in the neighbourhood of Vendôme. In this way he hoped to maintain as extended a circle of observation as possible, and at the same time to induce circumspection among such inhabitants as might be found here and there with arms in their hands. But in spite of these measures it was not possible to doubt that the opponent would ever be accurately informed by the country people of what was taking place on our side, as, in fact, he already knew well the numerical weakness of the detachment. The regularity also of the patrolling system with regard to time and place—almost all patrols being obliged to start early in order to return the same day—did not escape the attention of the watchful population.

On the 24th December Major Körber was detached to Épuisay with two battalions, two squadrons and a battery, charged with the task of driving the enemy out of St. Calais on the 25th. His patrols found Mondoubleau, Savigny and Bessé-sur-Braye clear of the enemy ; St. Calais, on the other hand, was still occupied. The Lancer patrol, which moved from Vendôme on the 24th towards the Braye brook by Montoire, was received at Sougé and Troo with fire ; at the latter place, however, from the country people. A trooper was here wounded and taken prisoner. On the 25th, Major Körber drove the enemy out of St. Calais by means of a few shells ; but before Bouloire the pursuing squadron was forced to retire in face of a somewhat strong infantry fire. According to the reports of the inhabitants of St. Calais, the main forces of the enemy had withdrawn the previous evening in a westerly direction. Major Körber then returned for the night to Épuisay.

The results of the reconnaissances which had been carried out up to the evening of the 25th December gave no colour to the idea of the advance of considerable hostile forces in an easterly direction; it appeared rather as if the enemy, who had been reported about Sougé, was not in strength, and possibly consisted only of bands of franc-tireurs and armed peasants. In order to clear up this point, and at the same time to punish the inhabitants of Troo and Sougé for their hostile behaviour towards his patrols, General von Kraatz resolved to send forward again, on the 26th, a flying column in the Loir valley, of the strength of six companies, a squadron, and two guns.¹

In the meantime, in the army of General Chanzy, which had reached the neighbourhood of Le Mans on the 23rd December, all possible measures were being taken to enable the troops to take the field again at the earliest moment. The 21st Corps had made good its retreat by Monfort, the 17th by Ardenay and St. Hubert des Rochers, the 16th by Parigné l'Evêque. A Division of the latter Corps under General Barry, however, remained in and about La Chartre-sur-le-Loir, Chahaignes and Jupilles, in order to keep up the connection with the troops which had been recently drawn together between the Loire and the Loir to cover Tours. After that General von Voigts-Rhetz, however, had forced back these in the action at Monnaie, the French Commander resolved to draw them up northward to General Barry, so that they might cover from a flanking position the roads leading up the Loir from Tours.

For the rest, till 23rd December, General Chanzy had contented himself with pushing forward on the main roads leading to the enemy small detachments of light troops. But the action of the German flying columns soon made it necessary to have stronger detached forces available in the front. On the above-named day, therefore, General Rousseau was ordered to advance in a north-easterly direction towards La Ferté Bernard and Nogent-le-Rotrou, with a strong detachment, whilst General de Jouffroy was to push forward with the 3rd Division of the 17th Corps on the right in the direction of Château Renault.

The task of the latter General comprised the reconnaissance of the entire district between the Loir and the Loire east of the railway Le Mans—Tours, the driving away of all hostile parties, and the facilitating the restoration of

¹ The exact distribution of the Xth Army Corps and the 1st Cavalry Division on the evening of 25th December was as follows:—

Detachment of General von Kraatz.

In Vendôme.—79th Regiment, Fusilier Battalion 53rd Regiment, 3rd Squadron 3rd Cuirassiers, 3rd Squadron 12th Lancers, 2nd Squadron 16th Dragoons, 4th Heavy, 4th Light and 3rd Horse Artillery Batteries Xth Army Corps, half No. 2 Sanitary Detachment.

In Épuisay.—1st and 2nd Battalions 56th Regiment, 3rd Squadron 3rd Cuirassiers, 4th Squadron 12th Lancers, 1st Horse Artillery Battery Xth Army Corps, half No. 2 Sanitary Detachment.

Detachment of General von Diringshofen.

In Herbault.—40th Infantry Brigade, 2nd Squadron 16th Dragoons, 3rd Squadron 8th Lancers, 3rd Heavy and 3rd Light Batteries Xth Army Corps.

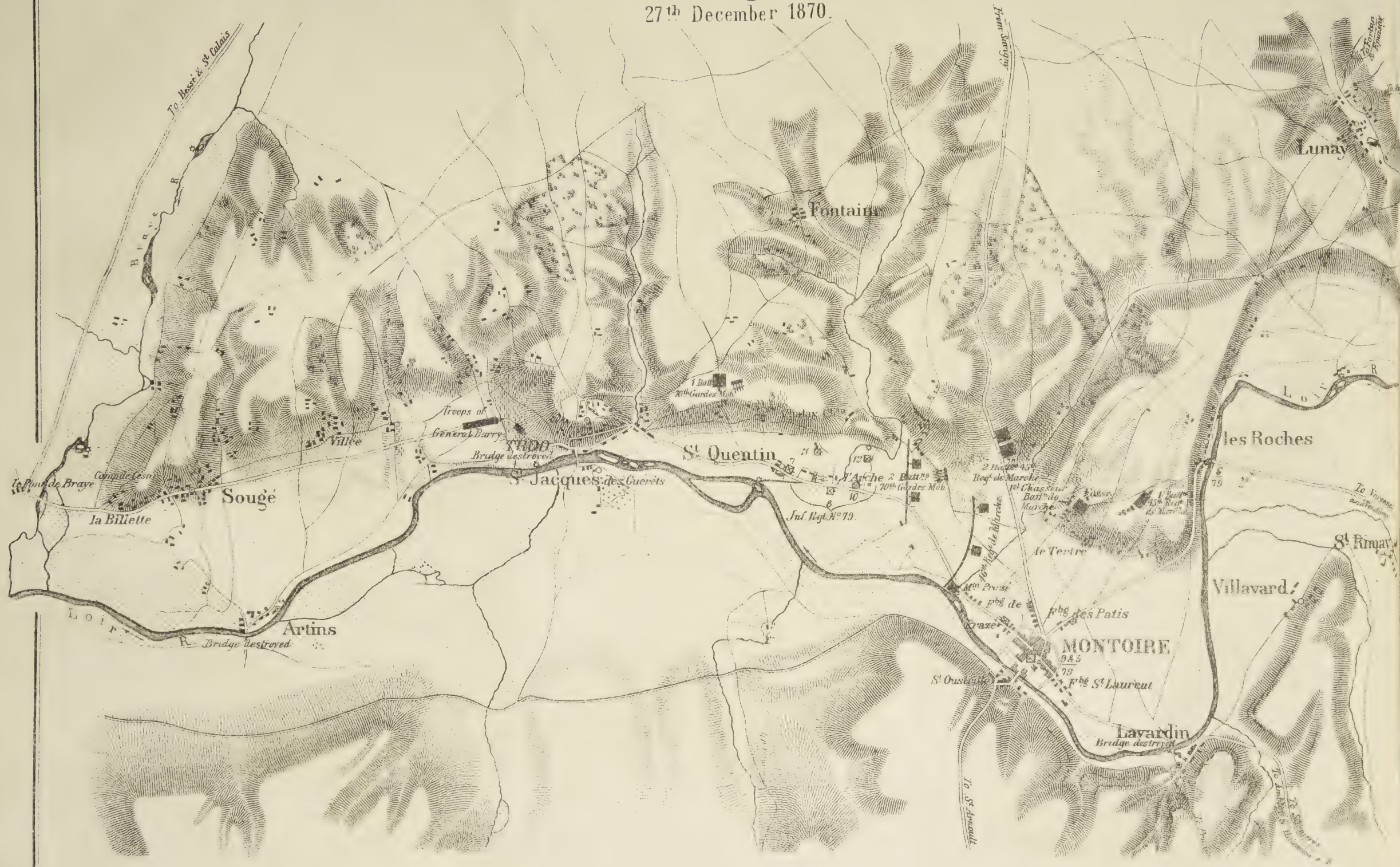
Main Body.

In Blois and Vienne.—Headquarters, Staff of 1st Cavalry Division and Corps Artillery. 19th Infantry Division, 10th Jäger Battalion, 3rd Squadron 8th Lancers, 1 pioneer company with Light Field Bridge Train, 3rd Field Division Xth Army Corps, half No. 3 Sanitary Detachment.

N. and N.E. of Blois.—1st Cavalry Brigade with 1st Horse Artillery Battery 1st Army Corps.

Sketch of the fight at Montoire.

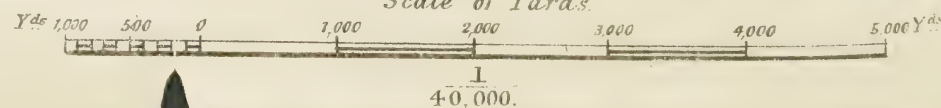
27th December 1870.



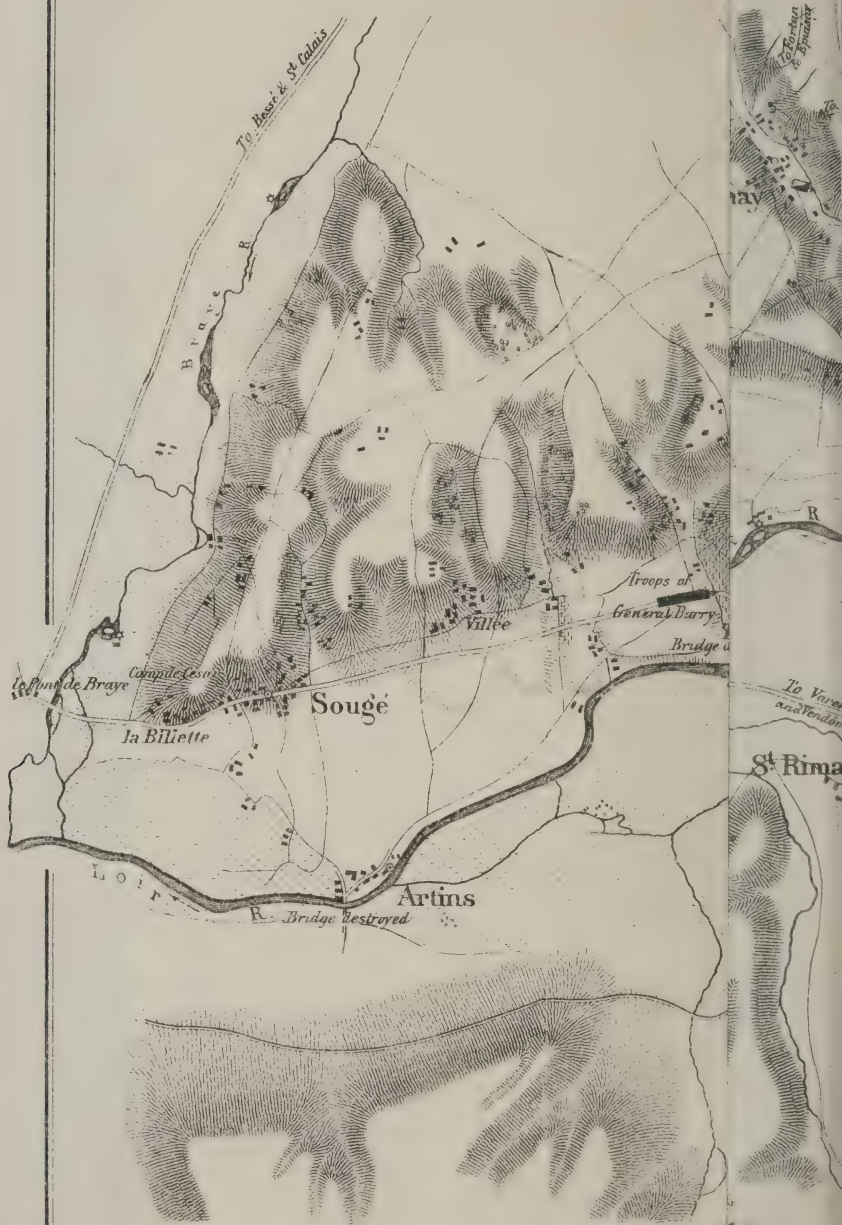
X
 Prussian troops
 French

at 2.30 P. M.

Note. Sufficiently exhaustive reports to distinguish all the French troops have not been obtained.



Sk



Prussian troops
 French

} at 2:30 P. M.

Note Sufficiently
French troop

1000 Yds

the railway line above named, which had been broken by General von Voigts-Rhetz. In case he considered reinforcements to be necessary, he was empowered to call on General Barry, who had occupied all the passages of the stream from Le Lude to Pont de Braye. At Château la Vallière the troops which had hitherto been under the command of General Ferri Pisani, and were now under General Clêret, were to be held ready, reinforced by 4,000 men under General Curten, who had been brought up from Chatellerault. Since, however, General von Voigts-Rhetz, as related, voluntarily retired on Verbaault and Blois soon after the action of Monnaie, General Clêret was able to occupy Tours again without fighting, and General Curten took post at and in front of Neuillé Pont Pierre to cover the railway line Le Mans—Tours.

On the 24th December General de Jouffroy moved off from his quarters behind Le Mans. In accordance with an order of General Chanzy, he had left behind in their former positions all the sick and stragglers, as well as all troops whose arms were defective and who were badly shod; the men were provided with a three days' iron ration, and since the railway Le Mans—Château du Loir was available for the transport of all that was necessary, the train could be reduced to a minimum.

General de Jouffroy had succeeded General de Flandre, who had fallen in the battle of Beaugency-Cravant, in the command of his Division, the 3rd of the 17th Corps. The Division consisted of two Brigades, with a total of thirteen battalions, three batteries and a section of Engineers.¹

For the undertaking before him 200 sabres of the Light Cavalry of the Corps were in addition attached to the Division. Brought together for the first time in the month of November, and originally designed for the occupation of the camp of Notre Dame d'Oé, it was pushed forward on the 20th November to join its Corps in the neighbourhood of Châteaudun. Continued bivouacs and numerous night marches tried severely the piecemeal organization of its troops before ever it came in sight of the enemy. In the skirmish at Brou and in the battle of Loigny-Poupry it suffered but slight losses; on the other hand, in the battle of Beaugency-Cravant on the 8th December, particularly in the attack on the latter place, undertaken with energy but completely defeated, its losses were considerable. From the effect of this day the Division appears to have recovered but slowly, at any rate its behaviour in the action of Montoire is sufficient evidence in favour of this supposition. The Bataillons-de-Marche were naturally its best elements, but even with these the great deficiency in subordinate leaders, though perhaps not so serious as with the Gardes Mobiles, had a very disadvantageous effect.

On the 24th December General de Jouffroy reached the district in front of Parigné l'Evêque; on the evening of the 25th he arrived at Courdemanche by way of Grand-Lucé. Here he learnt that in the course of the day St. Malais had been shelled by the Germans, and being in doubt whether he should continue his task or turn in the direction of that town, inquired from Le Mans concerning his further movements. In expectation of an answer he led his Division on the 26th to Bessé-sur-Braye.

General von Kraatz had appointed Lieutenant-Colonel von Boltensern of the 79th Infantry Regiment to the command of the flying column to be sent forward to the valley of the Loir on the 26th. The Divisional order in reference to this ran as follows:—

¹ Appendix No. 1 contains the ordre de bataille of the Division. The 76th Regiment of Gardes Mobiles mentioned therein appears, however, to have been amongst the remnants of the Division which had been left behind at Le Mans by order of General Chanzy, on account of their internal condition; at least it is not mentioned in any of the French accounts which treat of the action of Montoire and of the engagements which took place round Vendôme up to the end of December.

"To-morrow, 26th, at 8.30 P.M., a detachment consisting of the half of the 2nd Battalion, and the Fusilier Battalion of the 79th Regiment, one squadron of the 12th Lancers, and two guns of the 4th Light Battery, with two wagons of the Sanitary Department properly equipped, will be drawn up on the road to Montoire under the orders of Lieutenant-Colonel von Boltenstern, 79th Infantry Regiment. Till the return of the Detachment from Épuisay the outposts will be found by the Fusilier Battalion of the 56th Regiment alone.

"The patrols to Montoire will not be sent out by the Lancer Regiment till Lieutenant-Colonel von Boltenstern's return, which presumably will take place on the 28th."

The whole of the 2nd Battalion 79th Regiment was afterwards detailed to the Detachment by verbal order.

For the sake of giving more definite instructions General von Kraatz summoned Lieutenant-Colonel von Boltenstern to his presence on the afternoon of the 25th December. The Detachment was to advance on the 26th to Montoire, and, on the 27th, holding fast Montoire with some companies, to Sougé to clear up the situation at the Braye brook, and to seize hostages who should be responsible for the hostilities carried on by the population against the German patrols.

On the morning of the 26th December, at the appointed time, the Detachment stood ready in Vendôme at the exit towards Montoire. The advanced guard was formed by the 1st Squadron of the 12th Lancers under Captain von Porembsky, the 7th and 8th Companies 79th Regiment, and a division of the 4th Light Battery Xth Army Corps, under Lieutenant Bachmann. The Fusilier Battalion 79th Regiment followed these as main body, in rear of which was the baggage, succeeded by the 5th and 6th Companies. In this order the Detachment passed through Varennes without meeting with opposition, and continued its march on Les Roches. In the immediate neighbourhood of this place the head of the advanced guard was fired upon from the cover of a wood projecting on the road, and a Lancer was mortally wounded. The squadron trotted on without halting, and drew up in front of the further border, whilst the infantry in rear searched the strip of wood. Some twenty men in blouses, without proper arms, but in part provided with cartridges, were seized and temporarily brought on. In Les Roches the bridge, which had been restored by Major von Schmidt on the 21st December, was found to be still uninjured, so that, having crossed the Loir, patrols were pushed forward in a northerly and westerly direction, and the weak 6th Company, under Lieutenant Braunbehrens, having been left behind, the march could be continued to Montoire. This place was reached at 2.30.

Lieutenant-Colonel von Boltenstern caused alarm quarters to be taken up here under cover of cantonment guards. All the exits were strongly occupied, double sentries were pushed forward several hundred paces along the roads, and in the direction of Troo and Savigny Lancer patrols were detached, who, however, saw nothing of the enemy. During the night, the infantry alone provided the patrols. In the interior of the town an Officer's guard was established in the market-place. According to the reports of the inhabitants no regular troops of the enemy were in the neighbourhood generally, and franc-tireurs would only be met with singly. The Mayors of Les Roches and Montoire gave the same information. The friendly reception which the population gave to the troops seemed remarkable. But the punishment inflicted by Körber's Detachment on the neighbouring village of St. Calais was known, and appeared in this way not to have failed to exercise a beneficial influence on their minds.

In this way passed the night without interruption; the communication with the 6th Company, which had been left in Les Roches, being maintained without difficulty.

The duty which had been confided to Lieutenant Braunbehrens of securing

the stream at Les Roches was rendered considerably more difficult from the fact that this place is hemmed in between the Loir and the rocks, which rise almost immediately out of the river. Moreover, the company which had been left behind, and to which four mounted men were attached, counted in all only fifty-six men.¹ Two double posts, which were pushed forward along the exits to the north and south of the place—a village extending some distance, and forming only a single street—could only command the view in the westerly direction by continually patrolling to the steep plateau.

The guard of twenty-two men which was posted on the bridge was also to keep up at the same time an uninterrupted patrolling on the heights, but the complete security of the place was not aimed at on account of the difficulty of the ground. The additional task assigned to the weak post to reconnoitre in the direction of Savigny could also barely be fulfilled by the four mounted men available.

In the meanwhile, about 1 p.m., the Detachment of Major Körber had entered Vendôme again from Épuisay. His patrols pushed forward in the morning on St. Calais had found this place to be again occupied by the enemy. From the remaining systematically detached patrols General von Kraatz had received no fresh reports. At St. Arnoult, alone, a patrol of Dragoons was fired at by franc-tireurs. But in order to be duly informed, under all circumstances, concerning an action which, on the 27th, might become audible somewhere in the direction of Montoire, General von Kraatz ordered for the following day the posting of an Officer on the "Temple," a ruin on the heights on the left slope of the valley south of Vendôme, which had been arranged as a place of observation.

For the 27th, Lieutenant-Colonel von Boltenstern had decided to leave two companies in Montoire, the 5th and 9th, under Captain von Dobbeler, to maintain the passage of the stream, whilst the 6th, holding fast to Les Roches, was to obtain supplies from Lunay; with the remaining five companies, a squadron and two guns he intended to continue his advance towards the Braye district. Körber's Detachment was assumed to be still in the neighbourhood of St. Calais.

At 8 o'clock the advance from Montoire commenced. The advanced guard, under Captain Herzbruch, consisted of the Lancers and the 7th and 8th Companies; the main body followed with the 10th Company at the head, succeeded by the guns and ammunition wagons, then the 11th and 12th Companies, and behind them two wagons each of the sanitary detachment, small-arm ammunition, and ambulance.

The road from Montoire to Pont de Braye runs on the right bank of the Loir at the foot of steep heights, distant at first some 2,000 paces from the stream. Only a few narrow rocky paths lead to the ridge, the view over which is often restricted and which is covered with patches of wood and hedges. In the valley also movement to the side of the road was much hindered by extensive water meadows and numerous wet ditches. Near Troo the edge of the heights abutted immediately upon the stream, so that a narrow and easily defensible defile is formed here, behind which the valley once more widens out. The Loir itself was at this time covered with thin ice, which, however, did not bear, and all the crossings below Montoire were so completely destroyed by the French, that a restoration of these within a short time without previously prepared materials was not to be thought of. Any attack on the right flank of the advancing detachment would threaten to hem it in against the stream, whilst, on the other hand, its left flank was covered by the latter against any hostile enterprise.

The security of the right flank was to be provided for by sending off cavalry patrols at daybreak, which were to open up connection with the

¹ A great part of the company was still absent on prisoners' escort.

Detachment of Major Körber—still assumed to be on the road St. Calais—Vendôme. In consideration of the difficulties of the country these patrols were authorized not to return, in case they should meet with the other Detachment.

For the rest, the observation of the ground on this side during the march was to be limited to accompanying the column with the ordinary flank patrols.

Towards 10 o'clock Troo was reached, and from its houses, which are for the most part excavated from the rocks like caves, the advanced guard was frequently fired upon. Lieutenant-Colonel von Boltensstern ordered a thorough search of the place, which was known to be a main hiding-place of the swarms of franc-tireurs. All grown men were to be driven together, and brought on as hostages. The peculiar construction of the place, however, increased the difficulty of this task to such an extent that the commander of the Detachment, after a delay of nearly two hours, was compelled to decide to leave the 7th and 10th Companies behind, so as to continue his march to the Braye Brook with the small remaining force.

On the far side of Troo several deserted bivouacs were found close to the road, so that, in fact, as the inhabitants maintained, the mass of the swarms which had been traced here appeared to have retired in a westerly direction. But when the Lancers, under Lieutenant von Kurowski, at the head of the advanced guard, had reached Sougé, they came upon several earthen ramparts¹ from which, on their near approach, they were fired upon. Simultaneously hostile columns, apparently three battalions, appeared in sight, advancing from Pont de Braye, whilst from the earthworks near Sougé swarms of skirmishers deployed against this place. In the meantime the 8th Company had penetrated into Sougé. The advanced party, after it had moved several hundred paces along the village street, was suddenly fired into from the surrounding houses. After that the leader, Lieutenant Crome, had been mortally wounded, the subdivision retired again from the village. Nevertheless, Lieutenant Buhlers succeeded in forcing his way into the village again with an ambulance and some men, and rescuing the dying Officer from the enemy's hands. Lieutenant Bachmann, who had brought his two guns into action south of the road, now opened fire on the earth ramparts at a range of about 2,500 paces, and with such satisfactory results that the enemy there broke up and fled, partly to the north-west, partly to the village in front of them. In the meantime the 11th Company was extended on both sides of the road to receive the 8th Company, which had been recalled, and also to cover the guns.

Lieutenant-Colonel von Boltensstern recognized by this time that superior forces were in front of him. As the enemy, moreover, showed a desire to advance along the edge of the heights, so as to threaten the line of retreat of the Detachment, and a further delay appeared to be purposeless, he resolved to break off the action. As soon as the 8th Company had come up, the guns limbered up and followed the main body which was already retreating on Troo. The enemy pressed on with skirmishers forthwith from Sougé, into which place also, after it had been evacuated by the 8th Company, several shells had been sent. One of the guns was, therefore, obliged to unlimber repeatedly on the road, so as by well-directed shells to keep the enemy at a respectful distance.

Meanwhile patrols of the squadron, which was now marching with the main body, again attempted to climb the ridge; they observed there small hostile detachments of infantry, which, however, did not further molest the retreat. The rear-guard also was fired upon near Troo by armed peasants from the south bank of the Loir, but suffered no loss.

¹ There are here remains of an old Roman camp—the so-called "Cæsar's camp."

In Troo the searching of the labyrinth of caves, in which numerous arms, especially Chassepôts, were discovered, was not yet ended. A short halt again to be made. Here also a suspicious movement amongst the population was already observed, and moreover a single hostile horseman had been remarked. In spite of this the situation appeared to be in nowise dangerous, and still less so when Troo had already been left and the Detachment was in the act of marching on St. Quentin with the hostages which had been collected, some seventy in number. Then suddenly a cannon shot resounded from the ground north of Montoire.

General de Jouffroy, on the evening of the 26th, after his arrival in Bessé-sur-Braye, had at first been in doubt whether he should move on St. Calais or turn towards the Loir, but had then learnt from the Mayor of Les Roches of the presence of Boltenstern's Detachment in Montoire and Les Roches. He resolved, therefore, immediately to throw himself with all his forces on this hostile column, and moved off first towards Fontaine at earliest dawn on the 27th December.

His intelligence was accurate enough; the German detachment was reported to number 1,500 men, infantry and cavalry, and four guns. The French General had at his disposal from 8,000 to 10,000 men, three batteries and two mitrailleuses. In Fontaine he learned the later intelligence concerning the measures which had been taken by Lieutenant-Colonel von Boltenstern during the morning of the 27th. In Les Roches only 100 men, in Montoire only about 300, had remained, all the rest had marched on Troo. Only in reference to the passages of the Loir was the General falsely informed, since he fully believed that the bridge at Montoire, which the French had destroyed, had not yet been restored. So he resolved to obtain possession of the crossing at Les Roches, to occupy the road Montoire—Savigny, on a line with St. Quentin, and with the remainder of his troops to attack his opponent about Troo, so as to throw him back into the triangle St. Quentin—Les Roches—Montoire, and thus to compel him to surrender. In the town-hall of Fontaine General de Jouffroy acquainted his Officers with the general situation and gave out his last dispositions. No one doubted of success; “*Nous les tenons cette fois*” resounded soon through the French ranks.

A battalion of the 45th Régiment de Marche, the Éclaireurs of Gironde,¹ with a battery, was to attack Les Roches, the Chasseur Bataillon de Marche was to occupy Fosse, and the two other battalions of the 45th Régiment de Marche were to post themselves upon the road Savigny—Montoire on a line with St. Quentin. A reserve, formed of parts of the 2nd Brigade, was directed to remain at the commander's disposal between Fontaine and St. Quentin, whilst the remaining part of the division was to advance on Troo. It appears that the attack was directed later with three battalions and a battery against Troo, with five battalions,² a battery, and the mitrailleuses against Montoire, and with one battalion and a battery against Les Roches, whilst the cavalry reconnoitred towards Vendôme. The main column, that of the centre, had evidently divided itself in the course of the battle, as Montoire was only weakly attacked, whilst the main forces under General de Jouffroy's own leading appear, on the other hand, to have posted themselves east of St. Quentin directly across the road, and extending as far as the Loir.

Slowly as the movements of the French were carried out, the delay which had been caused to Lieutenant-Colonel von Boltenstern in Troo, and before Sougé,³ secured for them time enough completely to bar the line of retreat of

¹ The *ordre de bataille* does not make any mention of these éclaireurs.

² Including the reserve.

³ Here apparently they were in the neighbourhood of troops of General Barry (16th Corps).

the Germans, and they had succeeded in this, without the Lancer patrols, which had advanced in a northerly direction, and had been partly dispersed, bringing any intelligence to the Detachment concerning the French advance.

When Lieutenant-Colonel von Boltenstern heard the first artillery shots on his flank, he at first still believed that he only had to do with an action in which Körber's Detachment, which was supposed to be in that neighbourhood, was involved. By a rapid march he intended to hasten to its assistance. But soon the Lancers reconnoitring on that side reported that hostile infantry was visible on the heights north of Montoire; it was clear that the artillery fire was directed against his own Detachment. Near Ferme l'Arche Captain von Porembsky, marching at the head of the column, found himself suddenly in face of a hostile line of skirmishers, which held the space between the heights and the Loir. A division under Lieutenant Kirchner rode against this line, but was repulsed with loss. Again when the infantry reached the easternmost buildings of St. Quentin, the enemy's shells greeted them. There was now no room for doubt that they were surrounded, and had lost their line of retreat.

Lieutenant-Colonel von Boltenstern brought his two guns at once to the front, and they unlimbered between the easternmost building of St. Quentin and Ferme l'Arche on the road towards the left flank. They were received with a hot fire from all sides. In spite of the superiority of the French artillery, Lieutenant Bachmann directed his attention solely upon the opposing infantry some 1,100 paces in front of him. In the meanwhile the German infantry also had deployed on the threatened flank. The 10th Company was brought forward at a run to occupy the unimportant buildings of the Ferme l'Arche, near it on the right the 8th deployed a line of skirmishers in the ditches of the road, and occupied with the remainder a house standing alone. On both sides of the guns the 12th Company lined the ditches of the road, the 11th occupied a building on the extreme left flank with an adjoining stable and a ditch running from here to the heights west of Chalay Château. The 7th Company sought with the baggage a covered position in St. Quentin, where also the squadron found some protection against the enemy's fire.

The hostages which had been collected had hitherto been retained behind the 12th Company. They now believed that the moment of their deliverance had arrived. A large number of them broke away and endeavoured to escape by the rear. But the 7th Company, which had been retained in the rear, immediately deployed some of its men, and opened fire upon the fugitives, so that about thirty of these were killed or wounded, and only two succeeded in reaching the cover of a copse, whilst the remaining forty were secured and were obliged to seek cover in the ditches of the road against the fire of their countrymen.

The white clouds of smoke alone showed the lines of the enemy who was covered in deep ditches, and with his long-ranging weapons swept the ground in front and on the flanks, without being within reach of the fire of the German infantry. Lieutenant-Colonel von Boltenstern therefore advanced the 10th and 12th Companies a few hundred paces, where they took post in a ditch running from the heights to the road, so that their left flank extended half way to the heights. A hot musketry engagement soon developed here, during which columns could be seen in rear of the enemy's fighting line descending from the heights in the direction of the road. At the bend of the road to Montoire four detachments in close formation were visible. Behind the enemy's fighting line a battery had unlimbered, and had pushed forward two guns close up to a house standing by itself. After a short engagement these were put out of action by Lieutenant Bachmann, and

could only be moved to the rear with difficulty. But now a second line was sent deployed behind the first line of skirmishers, stronger than it and extending to the Loir.

In this way the action continued for about three-quarters of an hour, when suddenly the Detachment was fired upon by a battery which had driven up to the north-west of St. Quentin. The 7th Company therefore occupied the buildings situated there, and pushed its skirmishing division about 100 paces forward to a cutting. The shells of the newly arrived battery were directed for the most part against the squadron and the wagons parked in the village, the latter of which were almost completely destroyed. Captain von Porembsky, therefore, endeavoured to break through in a northerly direction, so as to reach the road Épuisay—Vendôme. The squadron succeeded in ascending the heights, but was here met by shell-fire, and a French battalion in close order barred the road. It was therefore obliged to return to St. Quentin, and to seek cover behind the wall of the churchyard.

Lieutenant Bachmann's guns also were in a serious plight. A gun commander, six men, and the hospital assistant had already been put out of action, six horses had been killed and two wounded. As the limber ammunition was already expended, shells had to be brought up singly from the ammunition wagons. Moreover a shell from the enemy struck one of the limbers, fortunately without exploding. After Lieutenant Bachmann had for a moment increased his fire to the utmost, the guns were withdrawn in order to be put into condition for further movements.

Lieutenant-Colonel von Boltenstern, who for long had recognized the desperate nature of his position, was convinced that further delay could now bring nothing but disadvantage. The bayonet must here open a way of escape! The preparations for a general forward movement were accordingly soon made. Four companies, counting from the right flank, the 8th, 10th, 12th, and 11th, were to throw themselves in a north-easterly direction in dispersed order upon the enemy, in order to force him back towards the heights, the 7th Company in close order with both the colours was to dash forward along the road, and the squadron as well as the guns were to follow as rapidly as possible on Montoire, as soon as the infantry had succeeded in breaking through the enemy's position at any point.

In this state of affairs the most complete coolness was necessary. In view of the possibility of their not succeeding in breaking through the enemy's lines, a fire was lighted by the 11th Company, so that the colours might be given up to the flames, rather than that they should be allowed to fall into the enemy's hands.

The 11th and 8th Companies first advanced into line with the 10th and 12th; then Lieutenant-Colonel von Boltenstern, by way of order to attack, gave the signal "The whole will advance."

Their Officers in front, the companies, now marching, now at a run, rushed with continued hurrahs across the intersected ground between the main road and the heights upon the enemy.

Almost without loss the first line was reached and broken through; scarcely did the enemy succeed in saving the guns which had driven up behind it; an ammunition wagon was captured. After a short halt the Germans rushed forward once more against the second French line. Here also the enemy's fire was hurried and consequently little effective, but this time he made a better stand, so that at several points an obstinate hand-to-hand encounter ensued. Then the deciding stroke fell on the right wing. The 7th Company had originally followed along the road in close order. The enemy had occupied the buildings of a mill on the Loir, and thence swept the road with full effect. The company leader, 1st Lieutenant von Hirschfeld, leaving the skirmishing division alone with the colours upon the road, bent away himself with the two other divisions to the Loir. In a short time the

buildings of the mill were captured, 1st Lieutenant von Hirschfeld, with Ensign von Reden and Vice-Sergeant-Major Gross were the first to force their way in. Six of the enemy's Officers, including a Staff Officer, were captured; in wild flight the opponents rushed across the road to the heights.

In the meantime the squadron and the artillery division had followed the 7th Company. They were ordered to reach Montoire at all hazards. Like the 7th Company, Captain von Porembsky bent away also from the road in a southerly direction, broke through the enemy's shooting line, and after riding past their supports which kept up a continuous fire, came upon broad ditches which compelled the squadron to dismount. Then once more they galloped through the hostile swarms, but these already were throwing away their arms, to seek shelter in the ditches from the fire of their own artillery. Speeding along close by the riverside the squadron at length reached Montoire. What had been left behind in its bold ride was afterwards saved from the hands of the enemy by the infantry following.

Lieutenant Bachmann had not left the road with his guns. Commencing at a trot, after breaking through the first line of the enemy's infantry, he had hastened onwards at an ever-increasing pace under the fire of the fugitives lying on both sides of the road. The second French skirmishing line was first visible when he had approached to within 200 paces. But now the near leader of the first gun fell dead with his driver, who was wounded. The second gun, the ammunition wagon, and a medicine cart without a driver trotted onward. Lieutenant Bachmann remained with the first gun, and had the leader disengaged, and the off leader unhooked. Then he hastened after the other gun. In the midst of the enemy's skirmishers the near wheel horse of the second gun fell. The Officer ordered the first gun and the ammunition wagon to hasten to Montoire at a gallop, whilst he himself, surrounded by the French at from 30 to 40 paces distance, endeavoured to get the second gun also into trim again. The dead horse lay directly before the limber wheels, and only three men were available to drag it aside. In wild haste the flying masses of the enemy rushed now from the mill past the gun. At length this also, though with only two horses yoked, was again ready to move off, and likewise succeeded in reaching Montoire at its best pace.

Being the first of all to arrive here, Lieutenant Bachmann halted in the market place in order to get the frozen bolts into workable order by greasing them. The teams also of both guns were brought up to four by harnessing riding horses.

In the meantime the enemy's second line also had been rolled up from the left flank, and thrown back into the hills. Two battalions in close order in the centre had, indeed, endeavoured to give a favourable turn to the action by advancing with skirmishers in front from the ground north of Fosse against the chaussée. They met with intermingled parts of the 8th, 10th, and 12th Companies, and compelled them to give way for a moment. Soon, however, the men of the 79th Regiment threw themselves once more upon the enemy; the latter did not await the onset, but now broke up and streamed backward. On the left flank the 11th Company, taking as objective a house standing by itself, had pressed forward, in spite of a hot flanking fire from ditches, hedges and copses, as far as the foot of the heights, and afterwards to the crest from whence it sent a rapid file-fire upon the enemy who was falling back upon Fontaine; twenty to twenty-five unwounded prisoners also fell into their hands. General de Jouffroy himself appears to have been in danger of being taken prisoner here. According to the report of a prisoner he had been surprised by the sudden advance of the Prussians, and had not been able to withdraw from the French fighting line. He had, therefore, remained concealed with his staff in a small house situated on the slope, which the attacking troops passed close by.

In the attack of the second line,¹ Major von Steinäcker, hastening on in front of all, was slightly wounded in the neck, Lieutenant Buhlers severely in the leg; 1st Lieutenant Niemeyer in the hand-to-hand encounter, from which two men freed him, received a thrust in the arm,² Vice-Sergeant-Major Ihssen fell severely wounded by two bullets. The behaviour of all was beyond praise.

Whilst the enemy fled, partly on Les Roches, partly on Fontaine, the 79th turned to Montoire. To facilitate the reassembling, as well as to indicate the direction, Major von Steinäcker made a bugler sound the call "Fusilier Battalion, half-right" for about twenty minutes. After that the companies which had advanced furthest in a northerly direction—the 11th and 12th—were in some measure collected, they also marched off, covered by a rear-guard, to Montoire. About 1,500 paces from the north-west entrance they reached the main road, on which companies of the enemy were already following them again. Lieutenant von Witowsky, who had remained somewhat in rear, was here taken prisoner.

It was past 4 o'clock, and was already beginning to grow dark, when the brave five companies were got into order in the market-place of Montoire, bringing with them as prisoners 10 Officers and more than 200 men of the enemy, as well as the hostages.³ About 4.30 Lieutenant-Colonel von Boltenstern had assembled his entire Detachment, excepting the 6th Company, left in Montoire.⁴ The baggage alone was for the most part lost.

On Montoire also, during the course of the day, several attacks, though not of a serious nature, had been made. Captain von Dobbeler, after Lieutenant-Colonel von Boltenstern had marched off, had had guards from the 9th Company posted at the exits of the suburbs Prazé and Patis, as well as on the bridge over the Loir. The 5th Company pushed a division to the north-east boundary of the town, and the remaining part of the Detachment took up a position in the market-place, the baggage-wagons being horsed.

About 1 o'clock a patrol from Vendôme came in with an order from General von Kraatz for Lieutenant-Colonel von Boltenstern. Being sent on to Troo, it turned back after about fifteen minutes, as strong hostile forces had been seen in front of St. Quentin. Shortly afterwards the breaking out of the action there was audible in Montoire. When the patrol again was directed to ride back with the report to Vendôme by Les Roches, this road was also found to be threatened by hostile detachments, visible on the heights of Les

¹ Lieutenant-Colonel von Boltenstern writes in reference to this:—"I myself was some eight or ten paces from Major von Steinäcker when I saw him suddenly turn and fall; a bugler and a drummer sprang forward to assist him, but half-raising himself, he threw or pushed them both from him with the words:—'Lads, let me alone, take care of yourselves!' Then he asked me whether he was bleeding much, and when I replied that he seemed to me to be not severely wounded, he quickly wrapped his pocket handkerchief on the bleeding place, and then ran back to the fighting line."

² The Officer and his opponent had fallen, and he was already lying under the Frenchman, when musketeer Voges and fusilier Friedrichs sprang to his help and bayoneted the latter.

³ The Staff Officer captured in the mill had refused to move on with the attack, on the ground that it was against the custom of war to lead prisoners against the enemy. Lieutenant-Colonel von Boltenstern answered that it was no matter on this occasion, and compelled him and his comrades to advance. The bearing of the German troops had not failed to impress the captives. The Staff Officer exclaimed repeatedly during the retreat—"Oh, what a scandal for the French Army; two battalions against 8,000 men!" When asked why he surrendered himself so quickly, he replied to Lieutenant-Colonel von Boltenstern—"Colonel, il est impossible de résister à un tel hourra!"

⁴ Montoire is clearly a misprint for Les Roches.—TR.

Roches. At the same time the post at the exit of the suburb Prazé reported that several columns, consisting of infantry and artillery, were visible, marching along the heights situated to the north, in an easterly direction.¹

Captain von Dobbeler hereupon took his measures for the defence of Montoire. He sent the two divisions of the 5th Company, which were with the main body, as a reinforcement to the exit towards Les Roches, and occupied the suburb Prazé with the 9th Company. At both places small bodies of the enemy's cavalry first moved forward against the town, then a battery drove up near Le Tertre and threw several shells over it; infantry, also in the strength of two companies, now came up between the roads to Savigny and Les Roches to within about 600 metres, and opened a lively but ineffective fire. A third company pushed forward at the same time along the road from Savigny, but gave way before a division of the 9th Company, which advanced against its flank from the suburb of Prazé. The enemy had stopped his artillery fire again after a short time, and soon drew off his infantry also in the direction of Les Roches. All these attacks were made without energy, and were completely discontinued after Lieutenant-Colonel von Boltensern had commenced to break through the enemy's lines.

With the closing-in of darkness snow showers had come on, which rendered invisible all distant objects. When the 11th and 12th Companies, closely followed by the enemy, had reached the entrance to the suburb Prazé, Major von Steinäcker left his Adjutant, Lieutenant von Heimbürg, with the division of the 9th Company which was posted here.

This Officer was just in the act of getting the division into order when close before him appeared a hostile detachment, which was at first taken for friends. The French Commander called upon the division to surrender, and at the same time challenged Lieutenant von Heimbürg to single combat. The latter answered the request with a volley, followed by file-fire. The enemy fell into confusion, and by this means the main body of the Detachment gained time to carry out, without further fighting, the evacuation of Montoire, which had been already determined on.

Lieutenant-Colonel von Boltensern was forced to the conviction that he was opposed by a greatly superior force of the enemy. Lancers pushed forwards towards Les Roches, and on the road St. Arnoult—Vendôme, reported that the latter road was clear, but in the direction of the former place, a few hundred yards from Montoire, hostile detachments were already visible. As a consequence of this the crossing at Les Roches was already presumably lost, and the commander of the Detachment decided therefore upon retreating across the Loir without delay, in spite of the fatigue of his troops, so that the enemy should not be able to bar his road again, by anticipating him from Les Roches on Ambloy.

Captain von Dobbeler, with the 5th and 9th Companies, was to take over the rear-guard, the remaining fusilier companies to form the advance, followed by the prisoners, hostages, and artillery; behind these the 7th and 8th Companies, the Lancers,² and all that was remaining of the baggage.³ The inhabitants of the town of Montoire, irritated at the carrying off of the prisoners, were only kept by serious measures from violence.

Without further losses the main body of the Detachment marched out of Montoire, and took the road to Lavardin. Lieutenant-Colonel von Boltensern remained personally on the bridge till the last baggage-wagon had crossed.

¹ The detachment sent by General de Jouffroy against Les Roches had, in fact, been misled by a guide, and was now for the first time marching against that place by a circuitous road close past Montoire.

² Later on the cavalry was moved to the head of the column.

³ Supply wagons which, during the advance on Sougé, had been left behind in Montoire with Captain von Dobbeler.

He then moved to the front to seek out the homeward road, in which he was greatly assisted by Lieutenant Fleischer, who had been with Major Schmidt von Knobelsdorf in Montoire on the 22nd December. After marching for an hour and a half a report came in that the baggage had remained behind, and that of the rear-guard also nothing more was to be seen. This report was brought by the train soldier of the 11th Company, who, running after the main body, reached it breathless, and said that, directly after moving off, the second baggage-wagon had broken its shafts, so that the column remained fast in a narrow cutting. In the meantime the French had pressed on into Montoire, and had captured the baggage and most of the drivers.

Lieutenant-Colonel von Boltenstern received no reports concerning the fate of his rear-guard. As, however, no action had been audible in rear, there was some ground for being at ease concerning its fate, whilst, on account of the over-fatigue of the men and the danger of the general situation, the turning back of the main body could not well be thought of. Therefore the march was continued without delay, the Detachment being still frequently fired at in the villages by peasants. About 11 o'clock p.m. they succeeded in reaching Vendôme, after the men, who were completely worn out, had, most of them, marched this day about 31 miles and taken part in a severe action.

Two hours later came in the rear-guard, also without loss. When it left Montoire, through the excited populace of which it had to force its way with levelled rifles, French troops had also already penetrated along the Loir into the town. In spite of this, Captain von Dobbeler found the bridge momentarily clear of the enemy and crossed the river without fighting. He succeeded, moving close past the enemy's columns, in gaining a start of 300 to 400 paces in the direction of St. Arnoult. On the freshly fallen snow it could now be seen that the main body had hit off another road; notwithstanding, Captain von Dobbeler resolved to continue on the road he had taken, as the enemy had again strongly occupied St. Oustrille, and so barred the way to Lavardin. He marched, therefore, to St. Arnoult, and from here, under the guidance of an inhabitant, by Prunay, Ambloy, and Huisseau-en-Beauce to Vendôme, where he safely arrived on the 28th December at 1 a.m.

Concerning the fate of his 6th Company Lieutenant-Colonel von Boltenstern first received information at Vendôme.

Lieutenant von Braunbehrens had received the report of the march of the Detachment on Sougé about 10 a.m., and with it an order was repeated to reconnoitre on Savigny, and to requisition oats and beef cattle in the localities situated on the heights. He detached, therefore, Lieutenant Wahnschaffe, about 11 o'clock, with 1 non-commissioned officer, 10 men, and 2 Lancers, to Lunay, so that he had left in Les Roches only 45 men and 2 Lancers, of which 1 non-commissioned officer and 22 men were posted as a picquet at the bridge over the Loir, whilst the remainder took up alarm quarters in the interior of the village. Between two and three in the afternoon the post at the exit towards Montoire reported that artillery fire was audible from that place. Immediately a patrol was sent on to the heights west of the village, but as soon as it arrived here it was met with fire from hostile skirmishers.

The detachment sent off by General de Jouffroy on Les Roches appeared now for the first time before this place, after that it had moved past Montoire, as related, and had temporarily taken part in the attack upon that town. Now also the fire of the double post stationed at the southern exit from the place sufficed to bar the entry from this side to the French.

As the hostile skirmishers deployed on the heights swept with their fire the village street and the bridge over the Loir, Lieutenant Braunbehrens decided to retire to the left bank. From the peculiar form of the village it resulted that an assistant-surgeon and 13 men, who were not able to get across the river quickly enough, fell into the hands of the enemy, who unexpectedly penetrated into the place. As the latter then shortly crossed the stream at a

mill-dam below the village, Lieutenant Braunbehrens had to evacuate his new position also and to retire along the Loir. In Varennes an order from General von Kraatz reached him, according to which he was to put out outposts towards Les Roches.

Lieutenant Wahnschaffe, who had been detached to Lunay, and whose departure had been delayed by difficulties which the Mayor of Les Roches had put in his way concerning the horsing of the necessary wagons, was occupied there with the execution of his task, when hostile horsemen, whose vicinity had been hitherto unknown, penetrated into the village and captured the weak party, in spite of stubborn resistance.¹

The consternation which took possession of the troops of General de Jouffroy, who had only been engaged in front of Les Roches, when they heard from fugitives of the events recently enacted at St. Quentin, is remarkable evidence of the great impression made upon the enemy by the bold charge of Lieutenant-Colonel von Boltenstern and his brave troops. They imagined themselves cut off, and sought in Les Roches for guides acquainted with the country, so as, if possible, to be able to escape by a circuitous route to Bessé-sur-Braye. Their minds were only set at rest when the General Staff Officer of the Division arrived in the night with the report of a pretended great victory of Montoire. General Chanzy likewise lauds in his book the action of St. Quentin as an important victory of the French. Somewhat different runs the report of an eye-witness. The latter admits that the enemy was believed to be safely caught in a trap, but he says, "we were far from this result; the battle-field remained in our hands, but the enemy had escaped us."²

General de Jouffroy assembled his troops at Montoire.

The Detachment of Lieutenant-Colonel von Boltenstern suffered in its expedition a total loss of about 150 men and 50 horses,³ but it had inflicted on the enemy a loss in killed and wounded at any rate very much greater, had made prisoners 10 Officers and above 230 men, and had moreover brought away 40 hostages. In truth it was a brilliant feat against a surrounding force eight times as numerous.

It remains still to follow out the events which took place in Vendôme in the course of 27th December.

About 1.15 P.M. the outposts and the Officer stationed at the observing post on a height south of the town reported that they heard some artillery fire in the direction of Montoire.⁴ Then when, after 2 o'clock, a stronger artillery

¹ The circumstance in detail was as follows:—When Lieutenant Wahnschaffe had arrived before Lunay, in a thick mist and a fall of fine snow, he caused the village to be examined by two patrols, and then charged the non-commissioned officer with the carrying out of the requisition, and betook himself with three men to the heights on the north of the village running towards Savigny, and upon them he posted the men as a standing patrol, whilst he himself returned again to the market-place. As the behaviour of the inhabitants appeared to be suspicious the requisition was hurried on, and then the march to Les Roches was commenced. At the head marched a Lancer; the standing patrol from the heights returned and followed as rear-guard. A delay in the village arose by the breaking loose of some cows. During this the leader of the detachment suddenly saw the moving cloaks of some Chasseurs à Cheval. Upon his command, "About! Fire!" a volley followed simultaneously from the opposing cavalry, by which two men were wounded. Lieutenant Wahnschaffe shouted to his men—"Out of the village, to the heights!" The order could, however, no longer be carried out, for already the leading Lancer came back followed by several hostile horsemen, and cavalry also was visible in the adjoining streets. In the attempt to gain the open through a garden the leader of the small party was captured, upon which the men met with the same fate.

² "Spectateur Militaire," Tome 29 (October—December, 1872), page 111.

³ Appendix II contains the detailed list of casualties.

⁴ The regularly detached patrol from the 12th Lancers, which left for Épuisay

fire became audible in Vendôme, General von Kraatz betook himself to the high ground before-mentioned, where the post of observation was erected, so as from there to follow the direction of the fire. At the same time he sent a patrol of Dragoons forward at a trot on the main road by Varennes with the commission to receive Lieutenant-Colonel von Boltenstern's report, which would probably meet them, and to bring it back with all despatch, but in any case to obtain intelligence of the column as soon as possible. As after the lapse of half-an-hour the artillery fire still continued, a particularly well-mounted non-commissioned officer, who hoped, by going alone, to be able to bring intelligence in the shortest time, was sent after the patrol with the same object. At the same time General von Kraatz caused a division of Lancers, under Lieutenant von Bonin, to advance upon Savigny by Fortan, in order to gain certain intelligence as to whether hostile forces had advanced into the space between the Loir and the main road—Vendôme—St. Calais—Le Mans.¹

From the battlefield, about 4 o'clock, the first information came in. Lieutenant Braunbehrens reported upon the advance at Les Roches, and added that he had lost touch with Montoire. The order already mentioned—to remain in the position of Varennes and to put out temporary outposts there—was immediately sent to him. At the same time it was ordered that two companies of the 56th Regiment should move off to the same point in order to take up there an outpost position for the night. After 4 o'clock the artillery fire at Montoire ceased. When the General had returned to Vendôme after the setting in of darkness, a question by telegraph as to the state of affairs came in at 5.30 P.M., from the Corps Commander, to whom General von Diringshofen had reported that artillery and small-arm fire was audible from the direction of St. Arnoult. A detachment of 2 battalions, 1½ squadrons, a light battery and some pioneers under Colonel von Ehrenberg had advanced from Herbault to Château Renault, on the 27th December, had occupied this place, had foraged in Villedomer and Auzouer, and had blown up the viaduct at Villedomer. The noise of the action at Montoire had been heard by this detachment as well as also in Herbault itself. Of the patrols pushed forward upon La Ferrière and St. Arnoult, the former had not come upon any enemy, on the other hand, the latter, which had advanced as far as Montoire, came upon the head of von Boltenstern's Detachment as it was marching back. Colonel von Ehrenberg took up alarm quarters in Château Renault in the evening.

General von Kraatz reported at once to Blois concerning the errand of von Boltenstern's Detachment, but with regard to its execution, he was not able as yet to give any information. He, however, communicated the occurrences at Les Roches as well as his intention to push forward, on the 28th, stronger detachments on both banks of the Loir. By carefully noting that the single cannon shots between 1 and 2 o'clock were only slightly audible, but that the hotter artillery fire between 2 and 4 o'clock was much more perceptible, and was exactly in the direction of Montoire and always in the same strength, the General had come to the conclusion that von Boltenstern's column had come upon superior hostile forces on the far side of Montoire, which were probably acting with the object of seizing this point situated on the flank of Vendôme. Lieutenant-Colonel von Boltenstern must have retired

at about 7.30 A.M., and had its heads towards Mondoubleau, St. Calais and Savigny, had found no trace of the enemy. The report was received at the Divisional Headquarters after the return of the patrol, which took place about 6 P.M.

¹ After a ride of over 38 miles this patrol returned about 10.30 P.M. It brought the report, certainly only partially correct, that the enemy had moved from St. Calais on Bessé and Troo, that Lunay and even Villiers were already occupied, and that strong cavalry patrols of the enemy had advanced from Lunay *via* Fortan on Épuisay.

to Montoire with the intention of accepting battle for the possession of that place, an assumption which Lieutenant Braunbehren's report appeared to confirm. The General reasoned further, that, as the battle on the 27th had continued till darkness came on, it would probably be renewed on the 28th for the possession of Montoire and Les Roches, and therefore detachments for both these points must be got into readiness. In order to increase the certainty of the success, he telegraphed at 6.40 to General von Voigts-Rhetz, asking that the detachment in Château Renault should be ordered to move on Montoire, and, if possible, in such a way that it should be able to reach that point at daybreak. It was added that the bridge of Montoire had been restored and that Lieutenant-Colonel von Boltensstern had probably come upon strong hostile forces at Troo or Sougé.

From the reply of General von Voigts-Rhetz it was evident that the latter regarded the situation as still more serious. It seemed to him doubtful whether the desired assistance could be given from Château Renault, at any rate at the hour mentioned. General von Diringshofen was, however, ordered to afford all possible support. But assistance could be obtained in the quickest and most effective way from Vendôme alone.

For the 28th General von Kraatz had, in the meanwhile, already ordered that the 1st Battalion 79th Regiment should be pushed forward on the right bank of the Loir, and two companies of the 56th Regiment on the left bank, to obtain intelligence concerning the position of Boltensstern's Detachment. It was also determined that, for the future, in addition to the patrols hitherto sent out, one should advance on the direct road Fortan—St. Calais, and should push its head as far as the neighbourhood of St. Calais. Till late in the evening news of the Detachment was awaited.¹ Then about 10 o'clock the first verbal report of Lieutenant-Colonel von Boltensstern concerning the danger they had gone through, as well as their forthcoming return, was brought in by Lieutenant Totenhöfer of the Lancer Regiment. At 10 o'clock this report was forwarded by telegraph to Blois.

H.R.H. Prince Frederick Charles did honour to the heroic behaviour of the Detachment by bringing it to the notice of the whole Army at the head of the order of the day of 31st December.

The expedition here described is a further proof that courage and resolution have almost ever availed to deliver a soldier from the most serious situations. And even if the bold resolution had not been rewarded with success on this occasion, still it is always better to fall with honour than to be fearful of resorting to the most extreme measures.

Dangerous situations, like that of Boltensstern's Detachment, will naturally be continually recurring in minor warfare, and especially in the case of the raids of flying columns. But the great advantages which a skilful strategy is able to draw from the action of such columns outweigh almost entirely the risks thereby incurred. In this case the heroic fight of Boltensstern's Detachment brought to General von Kraatz as its result a clearing up of the suddenly changed strategical situation. The latter knew now that the opponent who ten days ago had retreated upon Le Mans in apparently complete dispersion was beginning to bestir himself afresh. The action of Montoire formed, in fact, the introduction to the battles which took place around Vendôme at the close of the year. Hitherto, also, these detached columns had effected

¹ The patrols detached by General von Kraatz towards Montoire had first, when riding to Les Roches, come upon Lieutenant Braunbehrens with the remaining men of his party, had been turned back there, and had strayed in the darkness into the broken ground between Villavard and Houssay; finally, they had found Boltensstern's column on their return march; not, however, till the report of the commander had already been sent off to Vendôme.

what mere patrols could in no wise have accomplished ; the circle of observation in the direction of the enemy was cleared to a distance of two days' march, the enterprises of the inhabitants were kept down, and the supply of the troops remaining on the Loir was secured to the fullest extent. Certainly the task of these columns was as a rule a difficult one. The limited number of troops available at Vendôme rendered it always necessary that isolated columns should be sent into the country in front. Under such circumstances it was no doubt advantageous that the broken nature of the ground and the impossibility of seeing over it favoured undertakings of this nature ; but, on the other hand, the columns which advanced directly along the Loir valley itself, in spite of the security to their flank afforded by the river, found themselves, in consequence of the limitation of their movements resulting from it, at a considerable disadvantage with the more independent enemy operating upon the heights. Only a wide reconnaissance could remedy this, and a reconnaissance especially in the direction of the flanks. It follows from this that it is essential for flying columns to be as liberally provided with cavalry as is possible, and that for isolated advancing columns it is plainly more important to push this arm out far to the flanks than to the front. In the case under consideration, the commander of the Detachment was influenced by the circumstance that the squadron attached to him numbered only some seventy sabres, and on the morning of the 27th, after deducting the necessary detachments in Les Roches and Montoire, only fifty-four ; but above all, it was to be regretted that the squadron was pushed forward in the valley as advanced guard, instead of covering the flank on the heights with patrols pushed out far to the north and north-west.

A considerably more extensive system of patrols from Vendôme would not have provided the necessary security, even if their regularity—due to the long distances to be covered—had been lessened by making the detached cavalry parties pass the night at some point outside of the limit of security, instead of returning on the same day ; a measure which was frequently adopted by our cavalry in the wars of liberation also in winter time.

The expedition here related shows further that, by holding fast to Les Roches, no advantage resulted to the Detachment ; but, on the other hand, from the maintenance of Montoire a great advantage was gained, the importance of which was proved. If Montoire, like Les Roches, had been lost, the fate of the Detachment pushed forward on Sougé could hardly have been averted. In similar situations it would therefore appear judicious for numerically weak columns to occupy only the most important of the defiles in rear, but to occupy this in sufficient force. From the resolves of General von Kraatz, as his report to General von Voigts-Rhetz makes clear, it was evident, after the loss of Les Roches was known, that in consequence of his information he assumed the crossing of Montoire to be in the hand of Boltenstern's Detachment, which assumption, in fact, proved to be correct. In any other condition of affairs the arrival, about 4 p.m., of the report of the loss of Les Roches would most likely have called for the immediate carrying out of the measures projected for the support of Boltenstern's Detachment on the morrow, in spite of the advanced hour of the day, of the cessation of firing which soon ensued, and of the urgent need for saving the troops wearied with continuous outpost service.

With regard to the action of the opponent, it must in the first place be recognized that his Intelligence Department was decidedly well managed. Moreover, the idea upon which the individual orders of General de Jouffroy were founded, of driving the enemy out of Troo and St. Quentin into the angle of the Loir at Montoire, by capturing the bridge of Les Roches and holding fast to the heights, was clearly correct, especially as the General assumed that the bridge of Montoire was not passable. But according to the first orders issued with this object in view, the action ought to have taken a

different course to that it actually followed. Thus General de Jouffroy, as has been already pointed out before, after he saw Boltenstern's Detachment immediately before him, probably caused his main forces to wheel to the right, so that the left wing reached to the Loir. By this means the retreat of Boltenstern's Detachment was even now still barred, although the crossing of Montoire was in possession of the Germans. This alteration in the execution of the first orders was undoubtedly judicious, and would have been crowned with success, if the troops disposed of had been able to resist the determined attack of the Germans.

Thus, on this day, once again the ever-guiding principle of the Prussian Army of facing death with boldness did not fail.

APPENDIX I.

ORDRE DE BATAILLE

Of the 3rd Infantry Division, 17th Army Corps, 2nd French Army of the Loir,
on the 27th December, 1870.

Commander: General of Division de Jouffroy.
Chief of the Staff: Chef d'Escadron de Mourlan.
Commander of Artillery: Chef de Batterie Serron.
Commandant of Engineers: Chef de Bataillon Pavillon.

1st Brigade.

Commander: Colonel Didier.

1st Battalion Chasseurs à pied.
45th Infantry Regiment de Marche.
70th Regiment Gardes Mobiles (Lot).

2nd Brigade.

Commander: Colonel Santereau.

46th Infantry Regiment de Marche.
78th Regiment Gardes Mobiles (Ain, Aude, Isère).

Artillery.

20th Battery of the 8th Regiment.
" " 10th "
21st " 14th "

Engineers.

1 section of the 4th Company of the 1st Regiment.
Attached—200 sabres of the Light Cavalry of the 17th Army Corps.

APPENDIX IIb.

Nominal List of Killed, Wounded, and Missing Officers, Officiating Officers, and Surgeons, on the 27th December, 1870.

Staff and Regiments.	Killed, or Died of Wounds.	Wounded.
3rd Hanoverian Regiment, No. 79.	2nd Lieutenant Krome	No. 1. Maj. Baron v. Stein- äcker. No. 2. 1st Lieut. Niemeyer. No. 3. 2nd Lieut. Buhlers. ¹ No. 4. Vice Sergeant-Major Gross. No. 5. Vice Sergeant-Major Ihssen. ¹ <i>Missing.</i> No. 1. 1st Lt. v. Witowski. No. 2. 2nd Lt. Wahnschaffe. No. 3. Vice Sergeant-Major Feukner. No. 4. Vice Sergeant-Major Fahrenholz. No. 5. Assist.-Surg. Püllen. No. 6. Assist.-Surgeon Kyll. <i>Missing.</i>
Sanitary Detachment No. 2	Assistant-Surgeon Müller.

¹ Both severely wounded, and fell into the enemy's hands.

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LIEUT.-GENERAL SIR ARTHUR J. HERBERT, K.C.B., Quarter-master-General, in the Chair.

THE MUSKETRY TRAINING OF THE MILITIA.

By Colonel GEORGE G. WALKER (Commanding 3rd Battalion, Royal Scots Fusiliers).

RECENT military events in Zululand, in the Transvaal, and in Egypt have brought into prominence the question how far the fire of our British infantry is practically effective in the field, and it can hardly be maintained that to that question public opinion is disposed to return an altogether favourable reply.

It is not for me, as a member of the Auxiliary Forces, to pass a judgment on the shooting powers of our Infantry of the Line, though I will briefly express my opinion that our musketry system, if imperfect in the sense of being limited and insufficient, was yet sound in principle, that it was on the whole faithfully and intelligently carried out in our battalions, that it at least laid the right foundation for good shooting, and that those who complained of its incompleteness, and contrasted it unfavourably with that of the German and other armies, hardly took into sufficient account the immensely different conditions of armies permanently stationed, like most continental ones, in home quarters, with no other occupation than to prepare for the next great European struggle, and an army which, like ours, is ever on the move, which is constantly, both at home and abroad, split up into detachments, often on police rather than military duty, and which at home is in great measure debarred by the closeness of the country and the density of the population from carrying out satisfactorily the more advanced branches of military shooting.

But our battalions of the Line do not represent the whole effective of British infantry; behind the Line stands the Militia, a force comprising,

besides 35 brigades of Garrison Artillery, and 3 corps of Engineers, 138 battalions of infantry, or only three fewer than the Line, exclusive of the brigade of Guards. And this is no paper force: it exists; it is called out annually for training; it is liable for permanent duty in case of war or great emergency; it has on every occasion, when our country has armed for war, shown its warlike spirit by voluntarily offering to extend its services beyond the legal limits of its engagements; and, further, something approaching to one-fourth of the pick and flower of its rank and file is enrolled in the Militia Reserve, and is liable, therefore, in time of need, to reinforce the ranks of the line.

I submit, therefore, that it is a question of no mean national importance how far the men composing these 138 battalions are capable of using with effect the weapons placed in their hands.

For the present we are, as regards musketry, in a transition state: for last year the Snider, with which we had hitherto been armed, was replaced by the Martini-Henry, a measure the value of which it would be impossible to overrate, both as ensuring unity of rifle drill, and a uniform and single description of ammunition for both Line and Militia, and as placing in the hands of the latter an arm which, from the flatness of its trajectory and its greater velocity, remedies to some extent two of the weakest points with imperfectly instructed men, namely, inaccurate judging of distance and sighting, and the failure to make adequate allowance for the action of wind on the bullet. At the same time the allowance of practice ammunition was doubled, the distances fired at were extended from 300 to 600 yards, and the course of musketry drill, both for drilled men and recruits, was considerably extended. And yet further changes have been quite recently recommended by the Committee on Musketry which sat in 1881 and 1882.

From various causes, however, we have hardly sufficient data to enable us to judge how far the new armament and the changes inaugurated last year have been successful. Owing to the late issue of the orders modifying the practice, a large portion of the force, 47 battalions, were exercised under the old system; of the remainder, many were prevented by want of adequate ranges from carrying out the new course; 3 battalions, owing to an ambiguity in the wording of the order, went through the drill and practice laid down for recruits, and only 31 battalions, or parts of battalions, carried out the new course in its integrity.

It will therefore, I think, be desirable to divide our subject into two parts, considering first the results of our Militia musketry system, as it existed up to last spring, and then applying the results of the experience so gained, together with that of the partial and fragmentary performances of last year, to the question of how far we may count on satisfactory results and progress in the future.

With this object I have examined and analyzed, as far as possible, the Returns of the decennial period from 1872 to 1881 inclusive; and, though it is difficult, owing to various causes, such as the non-training of the Irish battalions in some years, the attendance of various corps at autumn manœuvres in others, frequent changes in the positions and distances of firing, &c., to arrive at strictly accurate data, I have

yet got near enough the facts to force on my conviction the following points:—

1. That, very short and elementary as was the course of instruction laid down, yet every year a considerable number of battalions from one cause or another omitted it altogether.
2. That every year a varying proportion of other battalions failed to bring to the targets a minimum of 70 per cent. of their strength, exclusive of recruits.
3. That of the remainder a considerable number were only trained by half-battalions in alternate years.
4. That both in the battalions and half-battalions classified as having gone through the course the number of non-trained men was excessive.
5. That the target practice of those men who were exercised left much to be desired.

The following facts and figures will, I fear, conclusively establish the above points:—

1. Of the 148 battalions the maximum number ever trained in one year was 95 battalions and 20 half-battalions, in 1878. Only in three other years out of the ten has the number of battalions and half-battalions together exceeded 100. The maximum number of men ever trained in one year was only 43,162, in 1880.
2. Once only, in 1880, no battalions were excluded from classification, owing to the insufficient numbers trained, the numbers so disqualified in the remaining nine years varying from 15 in 1873 to 2 in 1881.
3. Since the option of training by half-battalions was first given, in 1873, the numbers of battalions availing themselves of it have varied from 13 to 29, exceeding 20 in seven out of the ten years.
4. In the battalions and half-battalions actually trained the proportion of non-exercised men has only once in the ten years fallen below 10, while thrice it has exceeded 20 per cent.
5. The maximum number of points obtainable for the twenty rounds which were fired, at distances never exceeding 300 yards, being 80, the figure of merit of the whole force has never in any year exceeded 31.11, while it has been as low as 24.40.

If we turn from the decennial period which I have been considering, and the shortcomings of which are brought above into pretty strong relief, to the results obtained under the new system in 1882, we shall hardly, I fear, find them much more encouraging: for the total number of corps exercised in that year, both under the old system and the new, amounted only to 62 battalions and 23 half-battalions, leaving 52 battalions and 23 half-battalions entirely untrained. Of these, 12 appear to have omitted the practice owing to want of ranges. The total number of men in the whole force, exclusive of recruits, who went to the targets was only 34,961, the number of non-exercised men in the battalions and half-battalions actually exercised exceeding 11

per cent. Of the success of the target practice itself it will be, perhaps, more convenient to speak at a later period.

I fear I have already stated more facts and figures than enough to prove that the Militia is still, to a great extent, entirely untrained in shooting, and that the performances of the men who actually go to the targets are, to say the least, indifferent.

Objections may perhaps be urged against what may appear to some rather a pessimist view of the subject: it may be argued, for instance, that the non-training of the Irish Militia, which accounts for the non-exercising of a considerable number of battalions in some years, is temporary and exceptional. I would reply that the training of the Irish portion of the force has been omitted for no less than seven years, since 1865, and that partly owing to those breaks in their instruction, and partly owing to the want of range accommodation in Ireland, the target practice of that portion of the force has been attended generally with very partial and moderate success, a fact which cannot be left out of consideration in an attempt to estimate the military value of the whole.

A more specious objection would be that the Militia is, after all, only an Auxiliary Force, and that it is vain and unfair to expect from it the same proficiency either in musketry or drill that is demanded from the regular army.

This is perfectly true, as far as it goes; but, granting this relative inferiority, it does not follow that it should be, as it unquestionably is, far greater in shooting than in drill. The noble and gallant author of "The Soldier's Pocket Book," published in 1869, says in his chapter on campaigning (page 143), "As for drill, the worst Militia regiment can do enough for all practical purposes." But the Militia has immensely improved in drill since 1869, and I think it may be fairly admitted that any tolerably good Militia battalion is, in respect of drill, at least within measurable distance of a battalion of the Line. Will any one venture to say as much with regard to their relative proficiency in shooting, though this is with some reason considered one of the weakest points in our regular infantry?

It would not, I think, be hard to establish that, of the two, it is somewhat more important that the Militiaman should be thoroughly trained beforehand in shooting than in drill, inasmuch as musketry is a business essentially requiring the most minute individual instruction, ample time, ample space, numerous teachers, and various appliances of all kinds. Supposing, for instance, the Militia embodied on a sudden emergency, every spare hour, from the moment of its assembly to the moment of its going into action, could be utilized more or less for drill; we know that in the Franco-German War, Prussian battalions and even brigades were sometimes sent to drill at the end of the day's march, and that during the siege of Paris, every spare day was utilized for drill by those troops not actually in presence of the enemy. But to improvise any useful process of musketry-instruction under similar circumstances would be obviously impossible; and it may fairly be taken for granted that the measure of efficiency in shooting possessed by a battalion on its mobilization would be practically the same as that with which it would go into action.

If then I have established the fact that shooting is the weakest point in the Militia, both positively and relatively to the Line, there rises the question whether this inferiority is an accident inseparable from the nature of the Militia service, or whether it is due to causes admitting more or less of remedy, and, to arrive at a just conclusion, it will be desirable to look back at the history of rifle practice in the force.

We have not very far to go, for it is an institution of comparatively recent date. During the old French war the Militia were, I believe, exclusively "red soldiers," and their musketry practice was simple. I read recently, in the old order books of my own regiment, a brigade order, dated at the end of last century, when the corps was encamped on the East Coast of Scotland, and a French invasion was considered imminent, directing each regiment to fire twenty rounds of ball, and recommending to Commanding Officers the purchase of old herring barrels to serve as targets.

On the reconstitution of the Militia prior to the Crimean War a certain number of battalions were, on no very apparent principles, converted into Rifles, but only nominally so, as they, as well as the "red" battalions, were exclusively armed with the smooth-bore percussion musket, and it was not until the spring of 1858 that the Enfield rifle was issued to the battalions embodied during the Indian Mutiny. These corps were about the same time ordered to send Officers and non-commissioned officers to qualify as instructors at Hythe, and those of their number which continued to be embodied during 1858, 1859, and 1860 went annually through the same course as the Infantry of the Line, with results by no means unsatisfactory, as, although composed of young soldiers with no previous practice, and in competition with the Line, which had had the advantage of some previous acquaintance with the Minie and the Enfield rifle, several battalions took a fair place in the Annual Returns—one, in 1858, standing above fifty battalions and depôts of the Line. In one important respect this experiment was of substantial value, because it proved that the Militia could, after a comparatively short period of embodiment, provide sufficient and competent instructors from its own ranks, without drawing on the Line. Having myself been a Musketry Instructor at that time, and having put a battalion through the annual course, I can testify that some of the smartest and most successful musketry drills I had, were young lance-serjeants and corporals, whose service had been limited to the Militia. Some of these, on the disembodiment of their regiments, were placed on, and became valuable members of, the Permanent Staffs.

With the close of the Indian Mutiny, and the consequent disembodiment, came a very critical time for the Militia, and specially for its musketry. Retrenchment seemed urgent after the vast war expenditure of previous years; the enthusiasm which heralded the foundation of the Volunteer Force threw into shade the old constitutional army, the entire suppression of which was advocated both in Parliament and in the Press, not only by extreme politicians, to whom it was odious, both as a military body, swelling the Estimates, and as a force largely controlled and commanded by the territorial aristocracy,

but also by a class of theoretical military reformers, with whom ideal systems, based on foreign models, outweighed in value a force which, if, like so many of our institutions, anomalous in principle, has yet proved itself eminently national and valuable in practice. It has ever been to me a convincing proof of the value and practical character of the Militia, that it survived those years of grievous discouragement. But, though it did survive, it was very far from being unscathed. The length of the trainings was reduced in 1859 to twenty-one days, and, though raised to twenty-eight in the following year, it was again lowered to twenty-one in 1861, and remained at that figure till 1864. So unattractive at that time was the service that it was impossible to keep up the establishment of Officers: the rank of Ensign was abolished, or rather abolished itself; many battalions found it impossible to keep up the number of Captains; and an order had to be issued that, in the absence of sufficient Officers to command the companies, the colours need not be taken on parade. The force further suffered from the fact that not a few of the experienced Instructors of Musketry, who had learnt their work during embodiment, were tempted to leave the Militia by the offer of Adjutancies in the Volunteers, and in 1861 there were only nineteen qualified Officer Instructors remaining in the entire force. But what above all made any useful musketry instruction impossible at that time, and for many years after, was at first the entire absence, and subsequently the miserably inadequate extent, of the preliminary drill; for of this I am quite sure, that, however much we may differ on other points, there is no Militia Officer in this room but will agree with me that, to be of any use at all, our musketry system must have its foundation laid on the sound and thorough instruction of the recruit. But nothing of the kind was possible from 1859 to 1873: for the first two years of that period there was no preliminary drill whatever, while from 1861 to 1873 it varied in the most casual manner from seven days to twenty-eight, having twice been at the lowest figure of 7, seven times at 14, once at 21, and twice at 28 days.

I think I may say of the whole period from 1859 to 1873, and indeed of several subsequent years to a considerable extent, that, although battalions were annually ordered to go through a limited course of musketry, that branch of instruction occupied very much the same place in our Militia system that the study of modern languages did in our public schools some thirty years ago: on paper it formed part of the studies professedly taught, and, if any one chose to devote to it time that could very ill be spared from more remunerative work, he was welcome to do so. But practically it was more or less ignored: no credit whatever attached to its performance, no penalties whatever attended its neglect or its entire omission. I can recall a case in which, after a battalion had carried out the prescribed course with great zeal during a training limited to twenty-one days, sacrificing to it at least two-thirds of the scanty time available, it was inspected by an Officer holding an important Staff appointment, who totally ignored the existence of musketry throughout the whole proceedings, and when invited in the orderly-room to examine the registers

and Returns, declined to do so, giving as his reason that he knew nothing about musketry, and that he did not believe that any one else who had not been at Hythe, did. Undeterred by this, the battalion repeated the course in the following year, and this time was inspected by a veteran holding the appointment of Inspecting Field Officer, who likewise treated musketry as non-existent, excusing himself on the ground that he had never had anything to do with troops armed with rifles. I make no doubt that some of the Officers I see before me, can recall similar experiences.

Can it be matter for surprise that, up to 1873, the shooting of the Militia, conducted under such discouraging conditions, was miserably inefficient, and that Commanding Officers and Adjutants and serjeant-majors, despairing of producing satisfactory results, or of getting much credit for them if attained, and knowing well that the efficiency of their battalions would be judged very much more by marching past than by musketry, too often grudged every hour seemingly wasted on the latter, and gladly availed themselves of every plausible excuse for avoiding or curtailing it?

With 1873, however, there came at least the dawn and promise of better things, for in that year the preliminary drill was extended, for all battalions which were willing to avail themselves of this great advantage (and they were, I believe, the great majority), to fifty-six days, and for the first time it became possible to attempt some sound and systematic grounding of the recruits in the use of their weapons. But the mischief resulting from past years of neglect clogged and hampered progress, as indeed it still does to some extent, at every turn: the dislike and neglect of musketry among those responsible for the instruction of the Militia long survived such circumstances and conditions as those to which allusion has been made above, and which to a certain extent justified them. If any one will glance at the answers given by Commanding Officers to the queries addressed to them by the Royal Commission of 1876, he will find that no inconsiderable number of them roundly condemn the course of instruction then existing, and which continued with but little change till last year, as an utterly useless waste of time, while many others gave it only the most cold and qualified approval. Moreover the rank and file, and specially the non-commissioned officers not on the Staff, were, from the lack of previous thorough training, almost more difficult to deal with successfully than mere recruits; for they had become confirmed, by long habit, in faults which it was almost impossible to eradicate, and the ranks were long cumbered with these survivals of scamped instruction and desultory practice. Even to this day most of us are familiar with the shambling figure of the old re-engaged man, who has supplemented or supplanted his insufficient position drill on principles of his own, who faces the target in an attitude borrowed apparently from the bayonet exercise, who after an endlessly long and wavering attempt at aim spasmodically twitches the trigger with the tip of his finger, and accepts the jeers of his comrades at having ploughed a furrow in the turf 30 yards from the muzzle, or sent his bullet wandering in celestial space, with the callous stolidity bred of habitual failure.

In 1880 an experiment was made in the direction of giving a comparatively thorough course of training to a certain number of battalions, the idea being that corps thus instructed at certain intervals might altogether omit musketry in other years, and devote all available time to other drill. The fifteen battalions selected were made fairly representative, being drawn from England, Scotland, and Ireland. But the results were disappointing: the shooting was either moderate or indifferent; the system was generally, I believe, most unpopular with the Officers and men subjected to it, the general opinion being that whatever little gain was made in the shooting was more than counterbalanced by the falling off in drill and discipline; and it is, I imagine, safe to say that the experiment will not be repeated—a result not to be regretted, as it is contrary to all experience that men can be so thoroughly taught how to shoot as not to fall off in accuracy, if absolutely deprived of all practice for several years.

On the failure of this experiment, matters in 1881 practically reverted to the old groove so often traversed.

Under such unfavourable conditions progress could but be slow and gradual, yet progress there was: the numbers of only partially trained battalions visibly though slowly decreased between 1873 and 1881, and, though it is impossible, owing to changes made from time to time in the mode and distances at which the firing was conducted, to the accidents of weather, and other causes, to institute strictly accurate comparisons between the various years comprised in that period, there is a general and marked tendency towards improved shooting indicated in the Annual Returns.

I believe that that improvement would have been far more general and more rapid, but for two drawbacks, which I did not include among those with which we had to contend in the past, because unfortunately they belong not more to the past than to the present: they are most grave ones, and, until they have been effectually dealt with, must continue to be stumbling-blocks in the way of all real progress.

There is, in the first place, a most serious, and unfortunately an increasing, deficiency of properly qualified instructors. I am aware that the appointment of both Officer and sergeant Instructors has been recently discontinued in the Line, and that the training of the companies is entrusted for the future entirely to the company Officers. The Line may possibly be ripe for such an experiment, for during more than a quarter of a century they have been steadily preparing for it: during that period each battalion has always had one, generally two, subalterns who had qualified at Hythe, and consequently they now comprise in their higher ranks a very considerable proportion of Officers who have had practical experience in musketry instruction. In the Militia, unfortunately, this valuable leaven is almost entirely wanting; for, although for over twenty years it has been the rule on paper that each battalion should have a qualified instructor, a subaltern if possible, practice has in this matter lagged very far behind precept: little or no pains seems to have been taken to see the rule carried out, and, as a consequence, many battalions have, I believe, never had an instructor at all, the greatest number appearing in the Army List for any one year being 92 in 1873, and even this modest proportion

has fallen to 51 in 1883, so that at present we have 87 battalions out of 138 unprovided. And even this does not show the full measure of our shortcomings, for, although the order is that these appointments should be held by subalterns, if available, only 17 subaltern instructors appear in the Army List of last February, the remainder being Captains, who have held the post, some of them for many years, presumably because there were no subalterns willing and able to replace them. Those battalions which have been without instructors are of course pretty fully represented among those which in past years have omitted the annual course altogether. Others have endeavoured to make up the deficiency during training by borrowing Officers from the Line, a makeshift, precarious at all times, certain to be found wanting at any time of real emergency, and further involving the humiliating admission that we are unable to provide adequately for the instruction of our own men—a conclusion which, with some experience both of musketry and Militia, I feel bound emphatically to deny. It is impossible to doubt that in the past this want of qualified Officer Instructors has very largely contributed to the unsatisfactory results already indicated, and that the Militia has suffered much already, and must do so largely in the future, from the almost entire absence among the senior Officers of men who have had the advantage of a Hythe training. One instance has indeed come under my notice, where a battalion, by steadily adhering to the regulation of having a subaltern Instructor, now numbers six Officers, besides the Adjutant, holding Hythe certificates; but this is just one of those exceptions that prove the rule.

The deficiency in instructing power has, unfortunately, not been limited to Officers: one of the chief difficulties has always been the small number of really competent non-commissioned officers available for drill, and the large numbers consequently composing the squads, which, though ordered to consist of not more than ten men, could rarely be reduced much below double that number. The non-commissioned officers not on the staff, being little, if at all, better instructed in musketry than the rank and file, have generally been able to render but little assistance hitherto, and two staff-sergeants per company, supposing the staff to be complete, were woefully insufficient to give to sixty or eighty men, within the compass of a few days, or rather hours, the minute and detailed instruction which they required.

A second, and, if possible, a still more serious drawback than the want of instructing power, has been, and unfortunately still is, the entirely insufficient amount of range accommodation. A glance at the Annual Musketry Returns will show that every year a certain number of battalions, sometimes as many as thirty, are returned as having omitted target practice owing to want of ranges, and we may also, I think, safely conclude that a considerable proportion of those battalions reported to have omitted the course with “no reason assigned” have done so for the same reason. But, in addition to the battalions entirely debarred from target practice by this cause, there is a yet larger number which are most seriously impeded and inconvenienced both by the distance of the ranges from their headquarters and by the

inadequate number of targets, markers' butts, and other necessary appliances. And, though this evil has year by year very largely checked the proper training of the force, and caused the utmost inconvenience and discomfort to many corps, it has as yet been but little abated. The Annual Returns only give us the number of battalions entirely untrained owing to this course; but I have before me, thanks to the kindness of Major-General Cameron, C.B., commanding the Northern District, a circular memorandum giving the results of the practice carried out by the Militia under his command, from which I find that no less than fourteen out of forty-four battalions were either not instructed at all, or were only partially so, from want or insufficiency of ranges, and I have no reason to believe that the shortcoming has been less in other districts. There being very few Government ranges available, it has been necessary in a great many instances to hire those belonging to the Volunteers, and these, unfortunately, besides being often situated at most inconvenient distances, are in a great majority of cases unprovided with a number of targets in any way sufficient for putting 500 or 600 men through a course of practice in a space of time limited practically to about fourteen days.

Major Salmond, D.A.A.G. for Musketry in the North British District, in an official memorandum, dated this year, puts the case, as regards the Militia under his supervision, in the following terms:—"It is an utter impossibility for more than 400 men to get through that quantity (*i.e.*, forty rounds), and up to the full extent of 600 yards, on a range having only two targets (*i.e.*, a two-section range), *which is all that is available in the majority of cases.*" And I feel sure that many in this room will agree with me that nothing has done so much to make musketry unpopular—as in too many cases it unfortunately is, both with Officers and men—as the necessity for parading men at unseasonable hours, and detaining them on the ground for long and weary periods, too often in inclement weather, owing to deficient range accommodation. I have myself seen companies paraded at 3.15 A.M., in order to make use of a tidal range, and cases of similar inconvenience are only too common; some companies have a railway journey of 12 miles or more intervening between them and their targets.

I have, I believe, stated enough to prove that, if our progress in musketry has in the past been slow and halting, that result has been due to the fact that it has never really had a fair chance. It has always been treated as an extra, rather than as a matter of extreme importance; it is only within a very recent period that the extension of the preliminary drill admitted of any attempt to impart some solid system of instruction to our recruits, and we have had all along to carry out in an extremely limited time what ought to be a most minute course of individual training with a wholly inadequate amount of instructing power. Add to these drawbacks the absence and the inadequacy of ranges, and it will be seen that throughout we have been contending with immense difficulties, and that, if the results have been disappointing, this has been due rather to the very limited opportunities afforded to us than to any inherent weakness in the Militia system.

Let us now inquire how far the changes inaugurated last year are calculated to effect the improvement urgently required. Of the great and substantial advance made by the substitution of the Martini-Henry for the Snider rifle I have already spoken; and the changes in the drill and practice, both of recruits and trained soldiers, by the Army Circular 129 of 1882, are of at least equal value. The largely increased amount of musketry drill now exacted from the recruit must in the course of a few years fill our ranks with a class of men infinitely better trained than those we have now, though these latter are undeniably superior to those of ten years ago. Nor can I consider the time devoted to it, amounting on paper to fifteen and a half hours, but really occupying in practice something near a half more, if the work be thoroughly done, as at all excessive, or as interfering unduly with the other branches of instruction. I am of course well aware that under the new system adopted last year, of drilling our recruits immediately on enrolment, their adequate instruction in musketry has been attended with the greatest difficulty, and that the percentage of non-trained and only partially trained men, in battalions working under the new system, contrasts most unfavourably with that of those battalions which, owing to their being detached from the regimental headquarters, still drill all their recruits together, although by a very strange anomaly these latter, working on the old and condemned system, are allowed only fifty-six days to do the same work for which sixty-three days are allowed under the new. I cannot but hope, in the best interests of musketry, that we may yet retrace our steps in this matter, and revert to the old plan of drilling our recruits in one body, carrying them straight on from the preliminary drill to the training.

At present, owing to the men coming in by twos and threes, as enlisted, it is always difficult, sometimes impossible, to arrange them properly in squads for musketry instruction, and further, the dead months of winter, when civil employment is most scarce, being naturally the briskest time for recruiting, a large proportion of those who join have to go through their preliminary drill at a season of the year when it can only be conducted at the greatest disadvantage. The shortness of the winter day greatly limits the hours available for drill, and too frequently the inclemency of the weather either still further curtails them or makes them periods of discomfort, and almost misery, to the men. Position drill in February or March is too often the reverse of a genial occupation, though even that yields in cheerlessness to hanging about for hours at the same season on a wind-swept range.

But, however this question may be settled, I maintain that we ought to be able in sixty-three days to spare for musketry the proportion of time set apart for it by the circular of 1882, and that with very strict economy of time it may be just possible for those battalions which are, as I think, unfairly handicapped by being limited to fifty-six days, to compress the work into that period; and I confidently look forward to good results from this change, if faithfully and zealously carried out.

I will now pass on to consider the course of instruction laid down for the drilled men of the battalions in Table B of the same circular.

Among the answers, already referred to, given in by Commanding Officers to the queries of the Royal Commission of 1876, there are not a few which treat the possibility of carrying out any useful course of musketry within a period of twenty-seven days as entirely out of the question, and which suggest a prolongation of the training as the only solution of the difficulty; and if Officers, whose zeal and experience entitled their opinions to the greatest weight, entertained those objections to the course, as it existed in 1876, and which only exacted two hours' drill a day for four days, and two days of three hours each for practice, I fear they must entertain yet stronger objections to Table B.

But, while respecting their convictions, I must frankly say that I cannot agree with them. I concede at once that it is impossible in twenty-seven days to teach 600 or 700 men how to shoot. But that is the business, not of the training, but of the preliminary drill, and I am convinced by experience that, if the men have been fairly well grounded as recruits, it is quite possible, even within the very limited time available, not only to maintain the amount of knowledge and familiarity with their weapons already acquired, but year by year to improve upon it. Were it not so, I should feel disposed to regard the whole question with despair, for I look on the suggestion of prolonging the training in order to allow more time for musketry not only as hopeless of adoption from a financial point of view, but as one which, if adopted, would do the Militia more harm than good. You can, of course, do more work in forty-two or in fifty-six days than you can in twenty-seven, *provided always that you have the men to do it with*; but, so far as my experience goes, the present period is quite long enough for the men in general, and specially for those who are the most valuable element of the whole, those, namely, who are not the mere drifting waifs and strays of the population, but who by their steadiness and industry are able to command well-paid employment in civil life. This is a stratum of society which cannot be too largely drawn upon by the Militia. It furnishes a large proportion of the non-commissioned officers not on the Staff, and of that most valuable class, the re-engaged men. To many of these it is a considerable sacrifice of wages to turn out even for twenty-seven days: that they do so in such considerable numbers is, I think, one of the most satisfactory proofs of the popularity of the Militia, and of the strong *esprit de corps* existing in the battalions.

But I am convinced that to add a fortnight, or even a week, to the present period would drive many, and those the best, of this class out of the service, and that, in default of them, we should be driven more and more to compete with the Line for the "loafer" class, already much too numerous represented in both. Were confirmation required for what I have advanced on this point, I believe that it could be supplied by those Commanding Officers who had their training prolonged last year to fifty-six days, owing to the exigencies of the Egyptian War: though the men accepted the extension as a matter of duty, it was the reverse of popular, I believe, with the great majority of them. It was attended in many cases, I know, with considerable want and suffering

among their wives and families, and great difficulty was found by some of the men in resuming civil employment after so long an interval. It must be remembered that a large proportion of our rank and file is drawn from our large factories, the managers of which do not always view with a very favourable eye the enlisting of their hands, even for the present limited training; were it extended, I fear the notice, "No Militiaman need apply," would come into universal use, and we should thus dry up, by a stroke of the pen, one of our best recruiting grounds.

There is really no choice for us but to make the most of such time as we have, and, so far as the musketry drill laid down in Table B is concerned, I am not prepared to make more objection to the time required by it than in the case of Table A for recruits; considering the vital importance of the subject, it does not appear to me to be excessive, in proportion to the time still remaining at our disposal for other duties, while it is sufficient to do much towards confirming and improving what the men should have already been more thoroughly taught as recruits. I may here mention, though only to condemn it, a suggestion that has once or twice been made, that the recruits should be thoroughly trained in musketry once for all, and that the trainings should be exclusively devoted to other drill. I hold this to be utterly impracticable; we can indeed lay the foundations of good musketry in our recruits, and it should be our business to lay them sure and deep, but, to be of any good, they must be built upon in after years. The young lads who form the bulk of our recruits are incapable, physically as well as from the nervousness inseparable from the first essays at burning powder, of being made, as a rule, really good shots; in spite of their more extended period of instruction, and of the advantage they possess in always being drilled in comparatively small squads, their performances at the targets, so far as my experience goes, have always fallen very far short of those of the drilled men, although these latter still include among their numbers many men whose instruction as recruits had been either superficial or entirely neglected. The best shots soon fall off, without at least occasional practice, and it will hardly be alleged that the practice provided for the drilled men errs on the side of being excessive.

While approving, however, of the arrangements for musketry *drill* made in Table B, I cannot but think that, as regards practice, too much has been attempted, not in the number of rounds, but in the distances at which they have to be fired. I have already remarked that the results produced last year under the new system were too fragmentary to admit of our drawing thoroughly trustworthy conclusions from them, and the difficulty is enhanced by the fact that, owing to the existing system of centralization (if that can fairly be called centralization which consists in referring everything connected with musketry to a sea-side village in Kent), the results of that year's practice had not been in our hands till after the date at which it was necessary to place this lecture in the hands of the printer. Thanks, however, to the kindness and courtesy of the Inspector-General of Musketry, I was furnished early in last month with the figures recording the performances of the various battalions exercised, and in those

figures I find strong confirmation of my opinion that we have attempted too much.

Of the thirty-one battalions, or parts of battalions, exercised under the new system, one half-battalion only made a figure of merit exceeding fifty, while the figure of seventeen battalions was under forty. I cannot, I believe, better explain the significancy of these figures than by quoting again from the memorandum of the Deputy-Assistant Adjutant-General for Musketry for the Northern District. He says, with reference to the results of the practice in his district, "The trained Militia soldier has now to fire at the same distances as the Line recruit, viz., from 100 to 600 yards; the only difference is, the former expends half the number of rounds at each distance. If, therefore, we halve the results of the shooting of Line recruits, we shall have a standard by which to judge. Taking bad with good, I should say that the figure of merit (including volleys) of Line recruits is at least 112 points per man. It is very seldom, indeed, that the figure of any party is below 100, a good many regiments and depôts show between 120 and 130, and a few between 140 and 150. Taking the average as 112, and halving it, we have our standard figure of merit, viz., 56. But not one single battalion comes near this, although the men who fired were not Militia recruits, but men who had all had previous musketry training. The best figure is 47·94; the worst 28·66." And Major-General Cameron, C.B., commanding the same district, records his opinion on the same subject in the following terms:—"Making every allowance, the shooting is very very far from what it should be, and every effort must be made to reach a higher standard. . . . The Major-General is convinced, from what he has himself observed (the men are unable to stand up properly to their rifles when firing), that much more position drill is required for both recruits and trained soldiers."

It is, I venture to think, impossible to study the above facts and figures without coming to the conclusion that a great deal of the ammunition expended in order to produce these deplorable results was worse than wasted, that we have attempted too much in pushing our men on at once from 300 yards, which had been the maximum for many years, up to 600 yards, and that we should have made more real progress if, so long as our ranks comprise, as they do now, a large proportion of imperfectly trained men, we had contented ourselves with the course of *practice* laid down for recruits in Table A. I am very far from disparaging the value of long-range fire: it will always be valuable, for some operations of war it is essential; but battles are not won by it, and in every action there will be critical times and places where infantry who can fire with calm and accuracy within comparatively short range will make their mark. It should suffice us for the present to endeavour to work up to this standard, which, modest as it is, is yet still far above us; and, when the mass of our men are able to shoot steadily and quickly up to 400 yards, it will be time enough, and will then be a comparatively easy task, to carry them on further, or, what would in my humble opinion be the preferable course, to select those whose good shooting and general intelligence

gave good promise of further improvement, and to train them specially for the duties of marksmen, continuing to improve the remainder as far as possible in the delivery of that steady, accurate fire, at comparatively close range, which after all must be the main function of the mass of our infantry in action.

But, after all, the question of the distances at which the forty rounds should be expended is one of detail, though by no means an unimportant one, while, taken as a whole, the circular of 1882 marks a distinct stage of progress, from which valuable results may justly be expected. Unless, however, it be supplemented by other reforms, the progress made will, I fear, be slow and halting.

The first step should, I think, be to place the superintendence of the musketry, as well as of all other branches of instruction, wholly in the hands of the Generals Commanding districts, and, under them, of the Officers Commanding regimental districts. The present system of referring the battalion Returns to the Inspector-General of Musketry naturally predisposes the former Officers to leave mainly to him what appears to be his speciality, and rather to limit their own attention to the other details of instruction. But, unlike them, the Inspector-General, having no personal knowledge of the various corps, has no means of judging how far their practice may have been affected by bad weather, bad or insufficient ranges, or other causes, and how far the Returns can be accepted as representing fairly their shooting capabilities, while he can only after an interval little short of a year, and then in a comparatively circuitous manner, bring any pressure to bear to check such irregularities as do come under his notice.

To the urgent necessity for additional range accommodation I have already called attention, and I need only add that the present system of hiring ranges from the Volunteers is in very many cases not only insufficient, but costly. The Volunteers, having very heavy expenses of their own, can hardly be blamed if they make the most of the practical monopoly they enjoy; but I cannot but think that if the sums now annually paid for very insufficient accommodation were capitalized, very much might be done towards permanently providing really good ranges for both the Line and the Militia.

Whether the appointment of Instructor of Musketry be abolished or not in the Militia, as in the Line, it appears to me more essential than ever, if company Officers are to be made responsible for the shooting of their men, that some opportunities, beyond what can be afforded them during the annual trainings, should be given them of learning themselves what they have to teach. Whether this should be done by establishing a short course, say of one month, at Hythe for Militia Officers, or by temporarily establishing classes for the same period at the headquarters of districts, or by assembling the Officers of each battalion at their own headquarters before the training, is a matter of detail. But, unless something of the kind be done, disappointment must result: the Officers, despairing of teaching what they do not know themselves, will practically abandon the business to the over-worked staff-serjeants, and the system of Officers instructing their own companies must be a sham, and nothing else. I wish, rather than hope,

that this matter may not be overlooked, for while of late years very much has been done to promote the efficiency of the Militia privates, comparatively little has been done for the Officers who have to command them, and, while it is still too easy for the idle and indifferent to get on with a minimum of professional knowledge, it is still too difficult for those who are fond and proud of their work to find opportunities for making themselves masters of it.

Something more might also, I think, be done in supplementing our want of competent non-commissioned instructors by loans from the Line. Those fair hopes which were held out to us when the brigade depôt system was first established, of each battalion being able to borrow non-commissioned officers for the training from its own depôt, have, I fear, generally proved delusive; in my experience I have only once, in ten years, been able to borrow three, who proved so useless that I sent them back at the end of three days. But the necessity for such help is so pressing that I think that the question should be taken up systematically, and that in every district lists should be prepared of non-commissioned officers or men, belonging either to depôts or battalions of the Line, capable of drilling in musketry, or familiar with marking, and that these, so far as they might be available, should be told off to assist in the drill of the several Militia battalions.

It seems possible, also, that some assistance might be obtained from non-commissioned officers belonging to the Army Reserve, some of whom would probably be found willing, on receiving the pay of their rank, to be attached for this purpose for three weeks or a month to the Militia battalion nearest their place of residence.

I cannot profess to regret the proposed abolition of the regimental "figure of merit," as, owing to the various conditions under which different battalions shoot, and the varying degree of strictness with which the practices are carried out, and their results are recorded, the "figure of merit" failed in a great measure to provide a really trustworthy estimate of the shooting powers of the different corps, while it held out a premium for irregularities which have not been wholly unknown in the Line, and which can hardly be supposed to be non-existent in a force so little subject to supervision in its practice as the Militia. Still it seems desirable that, in some form or other, a healthy spirit of rivalry in shooting between the various corps should be kept up, and I do not think this could be better done than by the Government adopting and making its own the machinery and organization of the Army Inter-Regimental Rifle Matches, an organization which has done a great deal to promote a healthy interest in shooting in the Line, and which has most generously included the Militia in its operations, although as yet, I am sorry to say, we have not availed ourselves as fully as we might have done of its advantages.

It seems further to be a question whether, now that the "figure of merit" has been discontinued, some discretion might not be permitted as to not sending to the targets men who have proved themselves at drill incapable of doing any good there, and also of stopping the practice of men who have broken down on trial: men of both these categories would probably be far better employed in going through a

renewed course of drill, and in firing blank at empty cartridge cases,¹ than in wasting time and ammunition on the ranges.

The plan of training by half-battalions seems to require modification : in theory it may appear to have the advantage of allowing all the instructing power to be concentrated on a comparatively small number of men ; but in practice, so far as can be judged from the Annual Returns, the half-battalions show no superiority whatever over those corps which train all their companies. Moreover a plan having for its result that the soldier, during his five years' engagement, may only twice, and can only be thrice practised in musketry, seems self-condemned. In the case of battalions of ten companies, and of others which suffer from limited range accommodation, it may be impossible to train the whole, but in a great many cases this difficulty can hardly exist, judging from the very small numbers trained in many of the half-battalions, twelve of which last year each exercised less than 250 men. It would seem a much preferable arrangement for each battalion to carry out the course to the best of its ability every year, reporting the number of companies not exercised, and the reasons for the omission, to the General Officer Commanding the district, who would be in a position to judge how far the omission was due to unavoidable circumstances.

Authority should, I think, be given to such Commanding Officers as might desire it, to draw a certain proportion of ammunition, not exceeding five rounds per man, for private practice and match shooting, its consumption being accounted for in the Annual Returns.

While it may be impossible to devote more time than at present to the shooting of the rank and file generally, some of the old and thoroughly drilled men might occasionally with advantage spend an afternoon at the targets, instead of at the usual drills, and such an indulgence would be looked on as a privilege, and would do something to raise the general standard of the shooting.

I would further recommend the issue of three or four sets of the "Morris" attachment (rifled tube) to all battalions able to provide suitable ranges. I have two in use in my own battalion, and consider them valuable, as enabling recruits to become familiar with the handling and sighting of their weapons in practical use ; and, as an amusement, tending to keep men in camp, and out of the public-house, they have a value, quite independently of musketry.

Some such changes as the above should, I think, be made in order to give full effect to the new system inaugurated last year. But it is not our duty to sit still with our hands folded, awaiting the arrival of such reforms as we may think desirable. We have it in our own power, independently of all extraneous aid, to do very much towards levelling up the shooting of the Militia, if we really recognize its importance. It is not so much a question of how much, or how little, time we devote to it, as of the use we make of the time. If it be grudgingly given, if Commanding Officers and Adjutants count every moment lost that is not spent on their parades, if company Officers vote musketry drill a bore, and leave the drudgery of it to their staff-

¹ Firing blank at an empty cartridge case, placed on a wall or rail at a few paces' distance, is a good test of accuracy of aim and steadiness in pressing the trigger.

serjeants, the men are imitative enough to vote it a bore also, and the poor results at the targets, due to scamped and careless drill, will confirm them in the belief that the whole thing is a mistake, and a waste of time.

If, on the other hand, it be recognized that all other drill is a means to an end, that end being to bring the soldier into the position in which he can use his weapon to the best effect,—if the Commanding Officer is constantly present both at the ranges, and, what perhaps is even more useful, at the musketry drill,—if the company Officers take a keen and personal interest in getting their men into good position, and watch and coach them carefully and kindly at the targets, their influence will rapidly spread in the ranks, and in the pride and emulation between man and man, and company and company, will be found the leverage and motive power that is required.

I have hitherto abstained from touching on those recommendations of the War Office Committee on Musketry, presided over by Sir D. Lysons, which refer to the Militia, because they are as yet merely suggestions. Yet even as suggestions they demand our consideration. That it is desirable that the Militia recruit should receive the same amount of musketry training as the Line recruit is in theory unquestionable; that the shooting of the Militia soldier would be materially improved by his annually firing sixty rounds, instead of forty, as at present, is equally undeniable. But when we come to consider these suggestions practically, we are at once confronted by the difficulty of want of time. Whatever may be the shortcomings of the Militia, no one will, I think, venture to say that we do not pretty exhaustively utilize the time placed at our disposal. Every hour is appropriated, and we cannot possibly devote to musketry more time than we do at present, save by sacrificing some other kind of work. And I cannot but feel that, when it comes to be a question of what is and what is not essential, of what must at all costs be done, and what may be left undone, it might be well, by dispensing with some of the more ornamental portions of the field exercise, to reduce somewhat the great amount and variety of drill that we are expected to master, and so to spare a few more hours for perfecting our men in the use of their rifles. At present we have to master two entirely distinct tactical systems—the one that of the old two deep line, which holds so glorious a place in the history of British infantry; the other that which, in some form or other, has been forced on every European army by the introduction of breech-loading arms of precision, and which with us is represented by “the attack formation.” The old two deep line was the “attack formation” of Maida, of the Peninsula, and of Waterloo; it has been of necessity replaced by a more modern formation; yet, if any one examines Part III of the Field Exercise, he will find that about one-half of what is called battalion drill consists of varieties and combinations of the two deep line, and further that one considerable section is devoted to a variety of formations for receiving cavalry, though all modern experience teaches that the only practical formation for the latter purpose is to develop the largest possible front of fire, and to shoot as hard and fast as possible, so long as the cavalry are misguided enough to remain within range.

I am quite prepared to admit that the practice of these movements may have its value in making troops handy, *if there is time to teach them*. But, when it is merely a choice of what must be sacrificed, it might perhaps be as well at least to postpone the study of this class of manœuvres until the mass of our rank and file are somewhat less miserably incapable of shooting straight than they are at present.

I trust no one will so far misunderstand me as to suppose that I seek to disparage drill generally in favour of musketry: it is, I believe, impossible to be too strict in exacting the most faultless finish and precision in all movements performed; but there is all the difference in the world between good drill and complicated and unnecessary drill. To put the point practically, if, of two battalions, both equally able to move handily in any direction in quarter-column and in fours, and to work with intelligence and precision through all the phases and varieties of the attack formation, the one be able to shoot, and the other, *not* being able to shoot, can change front at less than a right angle on a central company, can retire in column of double companies and form line to a flank, can form a two deep square from line at the double, or perform faultlessly any other of the stately movements which go by the name of battalion drill, it seems to me that the first might prove a useful fighting unit, while the latter would be as sheep for the shambles in the day of battle.

It is of course our duty to do simply what we are told, and we shall continue to teach, if required, the same amount of manœuvres as heretofore; but we cannot make bricks without straw, we cannot make more than seven days in the week, or twenty-four hours in the day, and I must confess that for myself I can see no other plan than that which I have suggested that can render it possible for us largely to add to the time now devoted to musketry.

I may perhaps be asked what results I expect from the changes and reforms which I have advocated, supposing them to be carried out,—whether I believe it possible ultimately to make of the mass of our men finished marksmen, capable of shooting accurately at long range, and of meeting on equal terms such men as the Boers of South Africa. I answer emphatically, *No*, no more than I should expect, by training a party of city clerks to shoot at glass balls on Saturday afternoons, to make them fit to compete in shooting at driven grouse with the men who expend their thousands of cartridges at them every season. My ambition is a much humbler, but, I believe, a more practical one. I believe it to be quite possible, by honest effort on our own part, aided by assistance and encouragement from the authorities, to raise the general shooting of the Militia above the dead low level at which it unfortunately stands at present, and to make our men at least as formidable with their weapons—I will not say as the half-drilled Egyptian rabble, who yet made us pay dear for our victory in the twenty minutes' scramble of Tel-el-Kebir—but as the men who once and again hurled back the Russian and Roumanian columns, crushed and bleeding, from the entrenchments of Plevna, or those who lined the heights of Gravelotte, and choked the valley beneath them with the wreck and havoc of the Prussian Guard.

TABLE, giving results of *Militia Musketry Practice* from 1872 to 1881 inclusive.

Years.	Battalions exercised.	Total numbers of men minus recruits.	Total numbers of men exercised, minus recruits.	Numbers not exercised.	Percentage not exercised.	Rounds per man.	Ranges. (Yards.)		Battalion classification.				Total figure of merit.	Remarks.
									Very good.	Good.	Moderate.	Bad.		
1872	79	45,311	34,556	10,755	23·73	20	{ 150 200 250 300 standing kneeling		34	31	13	1	29·24	{ 6 battalions engaged at autumn manoeuvres.
1873	94	37,461	32,080	5,381	14·36	20	" "		33	32	20	9	28·28	10 do. do.
1874	89	39,792	33,273	6,519	16·36	20	" "		38	32	12	7	29·43	
1875	103	42,478	36,308	6,170	14·52	20	" "		34	39	24	6	28·39	
1876	91	40,836	34,918	5,918	14·48	20	{ 200 300 standing kneeling		10	33	29	19	24·92	7 battalions mobilized.
1877	104	47,786	40,674	7,112	14·88	20	" "		12	27	40	15	24·51	
1878	115	39,496	36,054	3,442	8·71	20	" "		34	39	24	6	24·40	
1879	38	23,901	17,149	6,752	28·24	20	" "		7	11	18	2	25·78	{ Musketry made optional, owing to training being reduced to 20 days.
1880	105*	49,134	43,162	5,972	12·15	20	" "		11	33	35	11	25·78	{ * Including 15 battalions specially exercised.
1881	93	43,383	34,352	9,031	20·81	20	{ 150 200 250 300 standing kneeling kneeling lying		48	37	6	0	31·11	Irish Militia not trained.

Colonel G. P. EVELYN (Commanding 3rd Battalion East Surrey Regiment): In the remarks that I am about to make I shall differ in some respects from the lecturer, although on a great many points I perfectly agree with him. It is not that I am apt to take a slight view of the musketry training of the Militia, for I think it is very well proved, by the figure of merit of my own battalion this year, which has headed the list, that we pay a great deal of attention to our shooting. Looking, however, at the limited period allowed us for training, I fear that there is a mistake in increasing the number of rounds. Twenty rounds are as many as we can manage, and I do not consider that any advantage would be gained by increasing them to forty; we have to fire in all weathers, and if there be bad weather it becomes a perfect nuisance to the men, and I am afraid is very apt to be inefficiently performed. It is always difficult to keep one's-self to one line of a subject, such as the musketry training of the Militia, without considering the musketry training on a larger scale as embracing the whole of the Service. I am inclined to think that a very great mistake has been made in increasing the number of rounds in the army; I doubt whether it will improve the shooting; it is always considered a great worry. Soldiers have a great deal to do besides shooting, and if you increase their work day after day, bringing them up to the targets in all weathers and at all times, they get so sick of the thing that, so far from improving the shooting, it will go back. We talk a great deal about the shooting of the Boers as being something that we cannot stand against, and that it would be impossible to make the English troops shoot as well. Why, we used always to thrash the Boers, and at the battle of Boem Platts, in which my old regiment—the Rifle Brigade—took a part years ago, there was no difficulty in taking the Dutch position,—certainly with considerable loss, but it was successfully stormed. In those days the Dutch were far better armed than we were. Now we have an excellent rifle, and are at least on an equality; but with all our great improvements in arms—long-range rifles, breech-loading, and so on—our shooting, as was proved at Majuba Hill, is really less efficient than it was in the days of smooth-bore muskets. Why is that? Because the better the arm we get, the more ammunition we waste in long ranges; so that really our shooting in action is less effective than it was when we had short-range arms, because we throw away our ammunition at long ranges. I believe almost the whole of our target practice should be done at very moderate ranges; it is far better practice. At long ranges you have errors in your rifle, the wind, and various matters to take into consideration, but at a moderate range, if the bullet does not hit, the fault is in the man and not the arm; the errors of wind, and the errors of deviation, are not sufficient to make any practical difference; if the rifle is held true it must hit the target at a moderate range; and I really believe that if our men were first of all taught that their object in action is not to fire away an immense quantity of rounds but to place one shot well, and if they were also taught that they are never to shoot at long ranges, and that battles, as the lecturer very properly said, are not won by the few casualties that occur at long-range shooting, we should then have no difficulty in thrashing the Boers or any one else. In point of fact, the Boers have no target practice; they now and then, in trying a new rifle, fire at a mark or break a bottle or two, but they have no regular target practice, and there are very few Boers in the whole country who fire sixty rounds of ammunition a year, or ever have done such a thing; and the proof that they cannot do so is easy to find. First of all they have no target practice, and as for their shooting, it is always at big game, which they seldom miss. If they fire many rounds the quantity of bucks that would be destroyed in the Transvaal would be something more than that prolific buck-country could afford. This is a very vast subject, and I will not attempt to discuss it further now, but I wish to impress on the Officers present the advantage of short-range firing, both for practice and in action, and to point out the well-attested fact, that the fire which proved so disastrous to our troops in attacking Laing's Neck, and defending Majuba Hill, was delivered at ranges from 40 to 60 yards, whilst our men fired away thousands of rounds at long ranges, and only hit at Majuba Hill three Boers and one horse.

Lieutenant-Colonel GARNHAM (late 6th West York Militia): I am sure most of the Officers present will agree with me in differing from the opinion expressed within the

last few years by a very distinguished General, to the effect that the British regimental Officer is the person who is to blame for any defects in the shooting of the British soldier ; but at the same time I am exceedingly glad that my friend Colonel Walker has given us this lecture, and has appealed to the Officers of the Militia to assist in improving the musketry instruction ; because I am perfectly certain that that is a very important factor in arriving at a better result, and that the Commanding and all Officers should make more of musketry than in many cases has been made of it. I feel that very strongly. But I am sorry to say I have to go further than that, as I think, however much the Officers of the Militia may exert themselves to teach their men, it is impossible for them to arrive at a satisfactory result in the present condition of things. The lecturer has alluded to making bricks without straw. Now I think our position is not only that of persons who are called upon to make bricks without straw, but very often after we have been able to get over the difficulty and to make bricks after a certain fashion, we have no opportunity given us for hardening those bricks and making them in any way useful for service. What we want is greater facility in the way of time and place for the carrying out of that important instruction in musketry. Facts are always better than theories, and my regiment happens to be one of those which in 1880 was told off for the purpose of going through the complete course of musketry instruction. I was delighted to hear it, and I may say most truly that I gave every possible assistance in my power ; but from the very first I felt it was my duty to point out the fact that the range which we were going to occupy was simply an impossible one. We had to take our men down a valley 600 feet deep, and up again 800 feet on the other side on to a moor, 1,000 feet above the sea, which had been condemned as unsafe and on which good shooting is impossible.¹ We were encamped on peat ground, 800 feet above the sea, which, in the weather they generally have in that district, was so soaked that I was obliged to send the whole of my battalion for three or four nights into billets in the town ; and my unfortunate men went through all this wretchedness, and then were supposed to be learning musketry under fair conditions. It may be asked whether under these conditions anybody was to blame. I do not think the regimental Officers were to blame in that case ; in fact I know they were not, because I had done my best to represent what would be the probable position. We had made applications to be taken to Fleetwood. There was no fault on the part of the Brigadier or of the Officer commanding the district ; everybody helped us in every possible way ; there was no want of co-operation or kindly feeling of the superior authorities, but there was the system at the back of all which does not recognize the importance of having places properly prepared for the proper instruction of the Militia. *It was the system which was at fault.* The barracks at Fleetwood were wanted for a few days only for some regiment which required to have its barracks whitewashed, and there was some little expense which might have been incurred, and therefore all our time and trouble were wasted. I was obliged to apply for special permission to have the course brought to an end, simply out of justice to my men ; but this permission was refused, and you can imagine how very unsatisfactory it was for a Commanding Officer, who was willing to give every assistance, to find that no good result was obtained from the special instruction. For the first week we were obliged to construct our own butts, for which working pay was refused, and I heard privately that the men complained. They said, "We do not come here to wheel wheelbarrows and to construct butts : we are labourers, we are men in mills, and we want to be taught some soldiering, instead of which we are employed in this way." I think, therefore, what we require is to have the system altered, by which in *all these matters* a strict but mistaken economy prevents the Civil and Financial Departments from seconding the efforts, not only of the Officers who command, but, as I have great pleasure in saying, also the noble efforts of those in high places who accept the reports of our difficulties, and are most willing to do everything they can for us. I quite agree with the lecturer that we want full preliminary musketry training for our recruits. We must instruct our recruits properly at first, but it is essential

¹ The regiment is this year to use the Volunteer range, the evils of the regimental range having been admitted after the result of 1880.

that we should follow it up afterwards. We must also have facilities afforded for Officers getting instruction at Hythe or elsewhere, and I think it fair to notice that not only is there great difficulty in getting Militia Officers appointed to Hythe, but it has happened to me on more than one occasion to be asked if I could use private interest to get young Line Officers admitted there, and the musketry accommodation at those schools is utterly insufficient for the wants of a country armed as this country now is. We must also remember that in many cases Militia Officers have been told that they may go to Hythe at their own expense. Now time was, when money was of very little object to many Officers of the Militia, and I believe that in some regiments there are still a great many wealthy men, but we have now a great many Officers who have come to us from the Line, and who know no more about musketry than the average well-instructed Militia Officer, and all those Officers will require to be instructed; and they are not, many of them, men to whom it is convenient to go and to pay so many pounds out of their own pocket in order to improve themselves in these branches. As to the question of ranges. If no range can be found near a regiment, surely ranges might be prepared where regiments might be moved, the expense of which is in no way to be regarded in comparison with the necessity of making the Militia effective. The regiments should be moved to these places; huts should be built, and they should be trained at proper ranges. Colonel Walker fears that prolonged trainings might injure the recruiting, but I do not think that when we went from three weeks to four weeks there was any diminution in the number of recruits; nor in my own regiment, when we went to the manœuvres for six weeks, did we find that the men came up any the worse. Nobody in this world is more opposed to billets than I am and always have been, and I am proud to think no one has said more in denunciation of what I must call the iniquitous system of putting the Militia in such billets as the low public-houses of this country than I have; but we must remember that the men would sooner go back to a warm billet-fire than go up to a cold wet camp where they have no means of drying themselves; and I think that some Commanding Officers will find that these things will make the Militia less popular. We must teach the men, but we must take care that in teaching them we do not make the service so unpleasant that they will not come to it. The withdrawal of the 10s. on enlistment no doubt has affected the recruiting of the Militia, and if, when they come up, they get nothing but musketry and wet jackets, I think we shall find fewer men come than at present. I cordially express my agreement with the lecturer in respect of the question of inspections. It is exceedingly disheartening for a Commanding Officer, who has done all that he can to promote musketry, to find that he does not make a good show on inspection. In 1880 our Brigadier most wisely refrained from any field inspection, and if musketry is to be properly looked after it will generally be necessary to strike out some of those manœuvres which are most pleasing to the Commanding Officers, and of which nobody was fonder than I was myself. I think it cannot but be for the benefit of the Militia that this subject should be brought forward. I may mention, with respect to the range, that it is a fact the range at Caterham, which is used by Her Majesty's Guards, is the property of a Volunteer Corps, and it is only by favour that Her Majesty's Guards can practise there, and they are limited to a certain hour for that practice. I do hope that such a state of things will not be allowed to continue, and that difficulties will be removed from the path of Officers who are anxious to raise musketry to its proper standard.

Lieutenant-Colonel Sir JOHN BURGOYNE, Bart.: As my battalion, the 3rd Bedfordshire, is one of an entirely different type to those of the three Commanding Officers who have spoken, it being entirely agricultural, I wish to say one or two words. I thoroughly agree with every word that has fallen from the gallant lecturer. The difficulties that we have had with regard to musketry have very much increased since July, 1881, and the new system of drilling recruits at the dépôt is, in my humble opinion, a most fatal one. It not only checks my recruiting so much that, instead of being up to full strength, we are now 160 men under our strength, but we have not the means of training our non-commissioned officers. As to musketry, no target practice of any sort or kind has been done at the dépôt for the last two years. We shall have close upon 300 men when we assemble next Monday who

have had no recruit course at all. Last year, thanks to General Elkington (to whom I think every Militia Officer will acknowledge we owe so much), my battalion was sent to Shorncliffe, to be trained with the first battalion. I mention this, because my battalion is the only one, I believe, in the Service that has been trained side by side with its first battalion, and a greater success could not be; but when I went down to Shorncliffe, full of zeal, thinking that I should have the means of training my men in musketry,—for I thought of all places in the world where I might possibly find a range it would be at Hythe,—to my deep disappointment I had the greatest difficulty even in finding any range at all, and I was only able to shoot a half-battalion: this year I hope to be able to shoot the whole of my battalion; but then, how am I to manage with my 300 recruits? I must either shoot men who have never been through a recruit course, or leave it alone, because there are only twenty-one days remaining, deducting the time occupied in travelling and the Sundays, and how is it possible to adequately train them in the time? There is one other point I would just mention, and that is that I think the authorities should give every Militia battalion at least one non-commissioned officer, who has a Hythe certificate, per company. I have three Captains and my Adjutant, who hold first-class certificates, and six sergeants, and I hope I shall be allowed two more.

Major-General MCKAY: Musketry is a subject that I have taken up, as I say, now for nearly thirty years, and when I heard the gallant Colonel's name mentioned to give this lecture, I said, "I will go and hear what is to be said on this subject." I quite sympathize with the Commanding Officers who have spoken with regard to their difficulties about musketry practice. I have experienced it, and unless the Militia have their ranges close at hand—within half-an-hour's walk of where they are located—it will be utterly impossible for them to give that attention to careful musketry training which is essential to their efficiency as an infantry force. I was rather staggered to hear musketry depreciated. We have an axiom in our drill-book that has been laid down ever since manœuvring was codified, and it is this: that all manœuvring is to place a man in the best position to use, not his bayonet only, but his rifle, and unless a man knows how to use his musket, whether he is brought to close quarters or is at a distance from his enemy, he is relying on a thing that will do him harm when it is needed for his safety and for the defence of his country; and you had better take it away from him and give him a club. There are one or two points Colonel Walker has alluded to which I think require a little explanation. One is about the centralization of supervision of musketry training. That of course became a necessity in the introduction of the system in 1853, but it has always been a mistake to suppose that it was ever intended to absolve the General Officer commanding a district, or a brigade, from his responsibility with regard to this essential portion of the training of troops; but I tell you what has happened—that musketry was ignored at the beginning; it was considered an incubus upon our drill, which, as a rule, only occupies an hour. Unfortunately for the success of musketry it occupies time; you cannot go and fire even a squad of ten men ten rounds per man in a minute, as they used to do in my early days, when the men were taken to the butts just before they went on a march, and fired volleys into the target, and if they exceeded an hour the unexpended portion of the ammunition went into the nearest dyke. Though it was laid down as far back as 1837 that the man was to be taught judging distances, the use of his sights, and was to be classified, how many were classified? I never had a lesson in judging distances or in the use of sights all the time I was in the ranks; but when the time came that you put a superior weapon into the soldier's hand, it became necessary that he should be instructed in its use; we must not put a superior thing into a man's hand and say that that inanimate thing is to be superior to the intellect that is to use it. No; if you get a good machine you must instruct men to use that machine; if you get a superior rifle you must instruct the men and develop their intelligence if they are to use that rifle skilfully. A good deal has been talked about Zululand. Why did our men fail there? It is very easy to see why they failed, and I can give many reasons. First of all, you can manœuvre in drill, like a machine; but you cannot make a man shoot as a machine. You must interest him in it; you must give him the why and the wherefore for everything he has to do; and you may rely upon this, that in cases of difficulty he will do that which has been instilled

into him as a matter of principle. When I commanded my regiment, and did a manœuvre, I did not think that I was injuring discipline, or that I was lowering my Officers, by telling them the reason why this was done, and why that was done; and I have even gone so far as to make mistakes and to ask them questions after the day's work had been done as to what I did that was wrong in detail. It gave them interest in their work, and the more you divert a soldier's mind in his instruction, the better. The rank and file is sometimes called a common soldier; it is the business of the Officer to make him by training an uncommon one. The rifle is only an arm of precision in the open in proportion to a man's knowledge of distances, the allowance to be made for wind, the shining of the sun, and so forth. The knowledge of distances is an absolute necessity for an independent use of the rifle in the open. We have taken that knowledge of distances away as a qualification from our marksmen. We have also taken the theoretical instruction test away; and then we are astonished that when the man gets into the open there is failure, the two elements of success in rifle training being removed. You can get a man to any pitch of perfection you please before a target, but take him into the open, as I have seen done in India, and he is nowhere without a knowledge of distances. And now I come to the figure of merit. The figure of merit, you may depend upon it, has a stimulating effect. When two regiments side by side are doing their musketry practice, I would ask, are we to abandon it simply because men are dishonest? Surely we must take higher ground than that? I do not believe that that can be the excuse for doing away with the figure of merit; all I say is, that I hope that time will prove the soundness of the judgment that recommended such a measure. I do not think my old chief, who was a man of the world, would, after his long experience in commanding a regiment, have recommended the figure of merit, unless he had been convinced of the soundness of such a proceeding to stimulate industry and interest in training. Are foreign armies abandoning a figure of merit? Why not go back to the old system of outer, centre, bull's-eye? for I think that by abandoning the figure of merit we are going backwards and not forwards in the cause of our musketry instruction. I quite agree that there is a difficulty in securing good sergeants for Militia regiments, but we experience a difficulty in the Line on our seven years' system. They won't grow like cabbages. They are a great element in the efficiency of our regiments, and the Militia will be worse rather than better off by the short service system. That is my view of the case; and as regards the training of recruits, I have had a little to do with brigade dépôts, and I can sympathize with Colonels of Militia regiments in wanting their recruits to be brought together for training a few weeks before the regiment assembles for the annual training. It will give them interest in their recruits, and will also give them the opportunity of having their non-commissioned officers trained preparatory to calling out the regiment. You may rely upon this, that as they have done away with instructors of musketry in the army, they will do away with instructors of musketry in the Militia; and I do not see how the musketry training is to get on in the Militia, without a Commanding Officer has some one man whose speciality it is to work up the regiment to a musketry efficiency. And as to the drill, I do say that there are too many manœuvres. What on earth do we want with them? We do not want show manœuvring; we want practical manœuvres, and we want the time to be devoted to the essentials of discipline and good shooting. I am very pleased to find that an old pupil of Hythe has prepared so good a paper to be read before this audience.

NOTE.—The value of the "figure of merit" in shooting is proved, if proof be required, by the great improvement in the rifle proficiency of the regiments serving in India when the instruction was under the supervision of Colonel, now Major-General, Gordon. It is said it is not a fair measure of efficiency, because the regiments do not fire under like conditions as regards weather. This is too weak. Do the men firing for the Queen's Prize at Wimbledon all shoot under the same conditions of weather, or has any shooting competition, where numbers are concerned, ever taken place where all things have been equal?

Captain READE: After the speech of the gallant General that we have just heard, I venture to state what has occurred for the last eight years in my own regiment, the 3rd Welsh. My regiment goes out into camp 2 miles from Cardiff; the

range is $4\frac{1}{2}$ miles from the camp; we have no means of getting there except by marching. The regiment is composed of 20 companies, and numbers from 1,000 to 1,100 strong. Now anybody conversant with musketry will see how impossible it is to give the men of that regiment, in twenty-seven days, the training that the gallant General has said is so absolutely necessary; and at the risk of seeming a pessimist it does seem to me that musketry instruction, conducted as it has been for eight years in my regiment, is a farce, a delusion, and a snare.

Major-General C. ROBERTSON: There was one sentence in Colonel Walker's paper which particularly struck me as showing the true military spirit which ought to inspire every Officer—the spirit which without cavil cheerfully accepts whatever conditions of service may be imposed by authority—the spirit which ignores impossibilities, which in the midst of difficulties is ever hopeful and fertile in resource, confident that where there is a will there is a way, and that, however adverse circumstances may be now, it is always possible to discover some expedient whereby good results may be obtained. The sentence I refer to was this:—"But it is not our duty to sit still with our hands folded, awaiting the arrival of such reforms as we may think desirable; we have it in our power, independently of all extraneous aid, to do very much towards levelling up the shooting of the Militia if we recognize its importance. It is not so much a question of how much or how little time we devote to it, as of the use we make of it." It may be interesting to mention that two years ago, at a Staff College dinner, I heard His Royal Highness the Commander-in-Chief make use of words exactly the same in spirit. His Royal Highness said: "In these times of change we know there are many Officers who are extremely opposed to many of the regulations which have been recently published; there are some of them which I myself do not like; but when I hear of Officers speaking of the total ruin and inefficiency of the army as the effect of these changes, I have no patience for such words. Let us not fear. The army is not ruined; it may still be relied on to do its duty, to perform nobly whatever services may be required of it. If any mistakes have been made experience will make them known and they will be corrected; in the meantime let every Officer accept the regulations and make the best of them."¹ Is not this exactly the spirit in which Colonel Walker spoke? With reference to the various excellent suggestions made by him for enabling the Militia to devote more time to musketry training, and for improving the methods of instruction, I was rather surprised at his omitting to mention the very obvious idea of making arrangements similar to those made by the Volunteers for enabling all men who have gone through the prescribed course of musketry instruction to practise ball firing at the ranges as frequently as they please, and at any time most convenient to each individual. I do not make this suggestion myself, but it seems so obvious, and likely to prove so effective, that I venture to put a question to Colonel Walker, and to ask him to inform us if it did not occur to him, or if he has considered it and does not approve of it. As regards the method of carrying out the suggestions, if no better could be devised, would it not be practicable to make arrangements for attaching squads of Militia to Volunteer Corps for this special purpose, and of employing Volunteer markers

¹ In the last paragraph of the epitome prefixed to the new edition of the "Historical Records of the King's Liverpool Regiment," recently published, the same idea is expressed in such apt words that it seems worth while to quote the passage:—"Military instructions are not exempt from the changes which time brings to all mundane things. Generations pass away, and others fill their places—the old order changeth, giving place to the new; but bronze cheeks and soldierly devotion were not the prerogative of any single generation, or the product of any special tactical system. It remains for the soldier of the future to enter into the true spirit of their regimental traditions,—to emulate that steady discipline which, no less than personal valour, distinguished those who preceded them,—and we may rest assured that whenever opportunities offer they will illustrate anew the motto of the King's Regiment, and of the Anglo-Saxon race, '*Nec aspera terrent*' (No difficulties dismay)."—"Historical Records of the King's Liverpool Regiment," 2nd edition, p. 40.

and instructors for keeping registers and recording the results of the extra practices of Militia squads?

Captain COCKBURN (late 42nd): There is one very startling statement that has been made this afternoon, namely, that the more rounds you give the men, the worse they shoot, with which I cannot agree, and fancy but few others will be found to do so; but I think every man of observation, who has had the opportunity of proving the fact practically in action, must have been struck with the wisdom of the remark made by the same speaker as to the danger, with long-range breech-loaders, of the men throwing away their ammunition uselessly at long ranges, and I think the great lesson to be taught, not only to the recruit but to the oldest soldier in the army, is to value every round of his ammunition as if his own life depended on it, and never to draw his trigger unless he is pretty certain of hitting his mark. Another observation that went to my heart was as to the non-commissioned officer. Now the non-commissioned officers are the backbone of the army, and of the Militia. You may make a soldier, as far as mere manœuvring goes, in a very short time. I have seen as many as 400 or 500 Coolies who, after a few minutes' drill, drove pigs out of a dense jungle nearly 3 miles broad, keeping their line and distances in a manner that would put into the shade many an old regiment in skirmishing order; but though a soldier may be taught all the manœuvring drill that it is necessary for him to know in actual action in a short time, it takes a long time to make the non-commissioned officers, for they cannot be grown like cabbages, as has been remarked by a previous speaker, and I would add heartily my little weight to that remark, which I am sure must have touched everybody's heart.

Captain TULLY (1st Tower Hamlets[R.V.B.]): With regard to the practical application of the instruction of musketry, I will tell you a short story. I am a shooting man. I have shot in the international teams. I have fired from 2,000 to 3,000 rounds in the year, and I have succeeded in walking off with a great number of prizes. I also went through a long course at Hythe. I went to the States, and went one day with some Officers of the army hunting. I took my rifle, and a herd of deer hove in sight. I carefully adjusted my sights and calculated the distances. I fired very carefully and missed. The deer, instead of being frightened, seemed to run straight for me. I fired again and again, and I am sorry to say I missed every shot. Now I have never fired at men, and I ask you to consider for one moment the position of a soldier, even one who has gone through the regulation course, when he is for the first time in his life brought before men armed with rifles like his own, shooting at him and trying to kill him. When the Officer who last spoke refers to the number of rounds being considered as an important element in teaching the soldier to shoot, I would ask the financial authorities to consider whether it is not worth while to give that soldier at least the value of the weapon he is armed with in ammunition to enable him to use it. For, as a pure matter of commerce, I should think that unless he were able to use his weapon it will be throwing the money away; and if you give him a rifle worth from 3*l.* to 4*l.* why should you expect him to perfect himself with a small number of rounds? I think that any expenditure necessary to make him useful in the use of his rifle is justifiable. I do not forget some years ago His Royal Highness the Duke of Cambridge saying the soldiers wanted more ammunition, and they would have to ask the House of Commons for it; and I remember Lord Elcho (now Lord Wemyss) rising and stating if His Royal Highness were to go to the House of Commons and say, We must have so much money for ammunition for the soldiers, we, that is the House of Commons, would have to give it you. If the authorities say they must have ammunition and they must have ranges, the House of Commons would be false to its traditions and its duty if it did not grant the requisition thus made.

Captain the Honourable HAROLD DILLON (4th Oxfordshire Light Infantry): I think one thing which would increase the interest of the Militiaman in shooting would be if the Officers of his company were in all cases to shoot with him. It makes the men take much more interest in the practice if they see the Officer shooting, and there is a friendly competition between him and the men. Those amongst the Officers who cannot shoot well would probably by that means be able to shoot better. Another thing I would suggest is, that all Captains of companies in the Militia should go to

Hythe for a month or two at least. It would also be desirable that the instructor should be a Captain or a man who had been in the army; something more than a subaltern of perhaps three trainings is required. A man who has been at Hythe, even if he has not been in the army, is at all events quicker to detect carelessness on the part of the soldier, both in handling his rifle and in shooting, than the man who goes up for his one month's training in the year. Of course if a man has been in the army he has lived amongst rifles, and can detect carelessness on the part of the soldier in a way which it is impossible to expect from the ordinary Militia Officer who comes up for one month.

Colonel Sir LUMLEY GRAHAM, Bart. : I will only take up your time for one or two minutes. I merely wish to refer to a point which has not been touched upon. No doubt the difficulty of the ranges is felt both by the Line and the Militia in carrying through their rifle practice in a really practical way, and this applies particularly to the second part of the course. It is not only a question of money, as some seem to think, but it is also a question of legislation. Unfortunately there are some landed proprietors who are unpatriotic enough to prefer their own interests to those of the country; and I know cases where there are excellent sites for ranges, but the landed proprietors cannot be induced to let the authorities have them. It appears to me that it is very necessary that Parliament should pass a Bill empowering the Government to take suitable land for the purpose of ranges at a fair price, just as a railway company may acquire land to make a railway. If a Bill were passed through Parliament for that purpose it would be a very important point gained.

The CHAIRMAN: The time has nearly expired, but perhaps you will allow me to say a few words. The provision of ranges comes a good deal under my department, and I know the excessive difficulty there is in persuading any one to let their land, even at high prices, for that purpose,—so much so that a correspondence took place only the other day with a landlord in Ireland, who for the privilege of shooting over a bog asked 300*l.* a year, the land in fee simple not being worth that money. We offered to buy the land at a fair price, but he refuses so sell it, because he knows we must come to his terms. Colonel Garnham said that it was advantageous to have ranges near barracks. A perfectly true remark, but utterly impossible in England. This country is so thickly populated, there are so many houses and farms, that day after day letters are received from landlords whose farmers have written to them to say that a shot has been heard, a pig killed, or something similar, at some excessively long distance beyond the targets. Whether these are exaggerations or not of course we cannot say, but the farmers write to their landlords and want to have their rents reduced on that account. The landlords send on to the military authorities, and state that we must stop the firing over that land. Three days ago a letter was received from one of the richest landed proprietors in England, saying that we were not to fire over his land, because some of the tenants said that they would not take on the farms at the same rent if the firing was continued. What are we to do? unless Parliament will grant the right of taking ranges forcibly, and even then it will be most difficult, because rifle practice cannot be permitted where there is danger to persons. Lately a letter was received from a gentleman residing near Wormwood Scrubbs stating that a bullet had been heard to whistle over his neighbourhood. The result was we had immediately to make estimates to raise the butts at a large cost; otherwise the range must have been done away with, and it is nearly the only one we have near London. Endeavours have been made to procure ranges which would answer for the Volunteers, the Militia, and the Line; but though permission could often be obtained for the Volunteers, because they were more careful, the proprietors objected to the Militia. Only yesterday I had a letter from a gentleman, himself a Colonel of Militia, to say that he did not object to the Line shooting at a range on his property, but he did object to the Militia regiment practising there. There are only about three or four places where field practices can be carried out at long ranges in the North of England. We have large Militia training barracks at Lichfield, where we have no range available, and these would be the most useful training barracks possible if ranges could be provided. I cannot say that I agree with General McKay in all his remarks on this subject. I entered the army

not very long after he did; with different regiments there are different practices; some were good, and some not quite as good. In the good regiments, the musketry instruction was not conducted in quite the slack way he mentions. I was told off as a very good rifle shot, at that time (the rifles were introduced in 1854), to instruct my regiment before we went to the Crimea, and I remember at Sandown, where we shot, our men were made to shoot fairly at 600 yards without any of the beautiful theories of lines of fire, trajectories, &c. I taught them how to aim, and what to aim at; I taught them how to judge distances, so far as I could, and to fire a volley; and I remember seeing a company fire at the targets at 600 yards, not knowing the distance, and I do not think a man of the company, that the target represented, would have escaped a hit of some sort. Much better than that cannot be accomplished with all the Hythe instruction. I entirely approve of musketry instruction in every way; but a figure of merit between a regiment shooting at Dartmoor, in the thick weather, over a rough country, and another shooting in a beautiful climate like Corfu, where there was often not a breath of wind, would be no fair comparison. Judging distances is what we want, and that ought to be carried out without the aid of the stadiometer. When I was commanding a brigade at Aldershot I happened to see a regiment judging distances for the prizes; they were judging distances very well indeed. The men I perceived were looking at the stadiometer by which the instructor was correcting the replies. I told him to turn it round, and then I found, though the men could judge their distances capitally before, afterwards, when the instrument was removed, they did not go near the mark; they were from 100 to 120 yards out. Talking to a district inspector, who had been an instructor at Hythe, I asked him to judge the distance of a cow which was 800 yards off, and he was above 200 yards out. He was a man who has the greatest faith in theoretic instruction. I made a guess at the same cow and went very much nearer, and I had never had any instruction at Hythe, but I had a good eye and was fond of judging distances. A soldier may learn to aim as correctly as possible, but he will not hit a man running while some one else is shooting at him. At the same time I greatly advocate constant rifle practice, and to fire away as many rounds as you can possibly procure; but not so with Militia. Militia never should practise at above 300 yards, with the exception of men selected by the Colonel for further instruction, and if possible they should be encouraged to shoot with the Volunteers.

Colonel WALKER: I regret that I cannot agree with Colonel Evelyn as to the amount of ammunition now afforded being excessive. I quite admit the great claims upon our time, and I quite admit that in the precarious climate we suffer from it is often very difficult to get through; but still I look upon the shooting as of such primary importance, that I should sacrifice almost everything to do it. I can only say that I have never, during the last twenty years, known a case in which we have not been able to get through the amount of firing required, and even this year we found no difficulty in putting my battalion through forty rounds, and going through our inspection quite to the satisfaction of the Commanding Officer. I am glad to find that I am in agreement with him on one point, and that is with regard to the comparative value of firing at short range; upon that we seem all agreed—that excessively long range, at any rate for the present, is not of practical use, and we should do better to limit ourselves to shorter ranges. My friend Colonel Garnham has alluded to the discomforts which men undergo under canvas, and has compared their comfort and efficiency in that condition to that of men in billets. Of course there is a certain amount of discomfort under canvas, but I would willingly at all times submit to it rather than revert to the condemned system of billets. My own battalion has trained for thirteen years under canvas, and when I say that we are situated on the south-west coast of Scotland, I think you will agree with me, it is not the driest climate in Great Britain; but in spite of that we manage to make our men fairly comfortable, and it is not unpopular with them. Colonel Garnham did not entirely agree with me as to the inadvisability of extending the training from four weeks to five or six, and he quoted the fact that there was very little falling off in the recruiting when the training was raised from twenty-one to twenty-eight days, and again that there was no reluctance on the part of men going out for the extra fortnight. I quite agree that there was no practical falling off in

recruiting up to the four weeks, but I do not think it at all follows that that figure should be raised higher. With regard to the extra fortnight for manœuvres I entirely agree there was no falling off whatever. I think it was excessively popular in my battalion, but that was an exceptional thing, and if that had happened every year, I am afraid the evils that I anticipate would occur. I am grieved to find my old friend and instructor, General McKay, to whom, only short of our friend and late chief, General Hay, I owe such little knowledge of musketry as I possess,—I am sorry that he does not agree with me as to the abolition of the figure of merit; but I am afraid Commanding Officers, and Officers who have had experience of shooting both in the Line and in the Militia, will agree that, however excellent in theory that system of the figure of merit may be, it has met with grievous abuses. General McKay will observe also, that while I do not object to the abolition of the figure of merit, I thought something at least might be done to replace it, and I am sure he is more familiar than I am with what I alluded to, namely, the system of the Inter-Regimental Rifle Matches, in which detachments of regiments, and individuals belonging to regiments are fairly pitted against each other when they shoot, not in the presence of their own instructors and non-commissioned officers only, but under the vigilant eye of an Officer belonging to another regiment, who has to testify on honour that the practice has been fairly conducted. My friend General Robertson has asked a question with regard to the possibility of supplementing the scanty time at our disposal during the training by getting our men to shoot during the non-training period. The circumstances of regiments are so different that what might be possible to some regiments might be entirely impossible to others. In my own regiment we do so. In three different towns from which I recruit, we carry on this practice every year; thanks to my friend Sir George Douglas, who commands the Volunteer battalion in that district, and who most kindly places his ranges at my disposal, and during the non-training period we fire from 2,000 to 3,000 rounds; the men are paraded with the utmost regularity, and march to the ranges just as steadily as if they were out for training; but what might be possible in my case might be impossible in others. Captain Cockburn has spoken of the waste of ammunition. Ammunition will be wasted whether men are well or ill-trained in musketry. It is not a question of musketry training; it is one of drill and subordination, and fire-discipline, and therefore it is a little beyond the object of my paper. I know that the best shots in the world, if they are not thoroughly under command, will infallibly waste their ammunition. I am glad to find that Captain Tully agrees with me as to the utter hopelessness of any mere mechanical process of teaching men to shoot, placing them on an equality with men who study in the great school of the hunting field. It is impossible by any mechanical process to make finished, practical riflemen of soldiers, such as the Boers, and other men who are constantly in the habit of shooting at large game for their livelihood. What we can attempt is to make our men equal, if not greatly superior, to the average of the rank and file of other European armies. Another Officer referred to the desirability of all Militia Officers going to Hythe. I heartily agree with him; but I am afraid if he is sanguine about that state of things being introduced, I cannot agree with him there. I know what an enormous difficulty it is to get one Officer to Hythe, and there is a young Officer in this room now who knows how many letters I had to write before I got him to Hythe. Sir Lumley Graham has directed our attention to the desirability of getting Parliamentary powers for the acquisition of ranges, and what he has said has been more than amply confirmed by our gallant Chairman. The case which our Chairman quoted was indeed a strong one, and the fact that an Officer, who himself for a long time commanded a regiment, should have kept a range open to the Volunteers, and have closed it to the Militia, is a very striking example of the difficulties to which we are exposed.

THE CHAIRMAN: It was not himself, it was his tenant who took the action.

Colonel WALKER: I am glad to be able to acquit him. But if it be the case that while the ranges are kept open to Volunteers because they are more careful in practice, they are refused to the Militia because they are not so careful, I think I may be said to have proved my case, and that some reform is absolutely and urgently called for. I am sure I should be ungrateful if I sat down without asking you to join with me in giving our hearty thanks to Sir Arthur Herbert for his great kindness in occupying the Chair to-day, and for the keen and lively interest he has always taken in the Militia service.

The CHAIRMAN: I thank you for your kindness, and I beg to ask you all to join with me in voting our thanks to our gallant lecturer, for his very instructive lecture. It has not been a mere theoretical discourse, but it has been a lecture which we have all been able fully to understand and appreciate. I may state that in one year I inspected fourteen Militia regiments, and cannot agree that it is the fault of the inspecting Officer that musketry is not carried out, because where ranges are distant, Commanding Officers usually do not take much interest in the musketry instruction. Many in Ireland begged me not to ask questions upon that subject, but to see how well they drilled. Now the inspecting Officer is obliged, to a certain extent, to conform to the wishes of the Colonel of the Militia, as it is useless to inspect what has not been practised, and I therefore only saw two regiments fire out of the whole lot, and they did not fire so badly. Some of the other regiments I believe never fired at all, but they drilled remarkably well. I beg to return our best thanks to Colonel Walker for his lecture.

Friday, June 1, 1883.

COLONEL SIR CHARLES H. NUGENT, K.C.B., R.E., Member of
Council, in the Chair.

MILITARY BALLOONING.

By Lieutenant B. BADEN-POWELL, Scots Guards.

(1.) *Introductory.*

IN dealing with the subject of military ballooning, I propose first of all to take a brief historical view of the uses to which balloons have been put in actual warfare, and of experiments conducted on the subject, and after that to consider in order,—the causes of success and failure in ascents; the relative advantages and disadvantages of captive and free balloons; the means and methods of inflation; and lastly, the question of navigating balloons.

In Clery's "Minor Tactics," we are told that "good information about the enemy's force, position, and movements is the first step towards victory," and in Lord Wolseley's "Soldier's Pocket Book," that "one of the most effective means of learning the whereabouts and doings of an enemy is by means of balloons." This being so, it seems surprising that a body of *aéronauts* does not form a regular branch of every civilized army.

Balloons, it is scarcely necessary to point out, have been and may be made use of on many different occasions in warfare. They may be carried with the advanced parties, and sent up to ascertain the position of the enemy, and the nature of the country ahead. They may be employed to reconnoitre the enemy's position previous to a battle. They may be utilized in noting the formation and movements of the troops, and position of the reserves during an engagement. They could often be beneficially employed as sentries on outpost duty, and would be exceedingly useful during sieges. Besides this, they may often prove invaluable for escape, communication, or signalling, when other means fail.

(2.) *Historical View.*

Soon after the invention of balloons, just 100 years ago (the first balloon which ascended in public was launched by Montgolfier on June 5th, 1783), military authorities perceived the immense value their employment might prove in war, and in 1793 the French

Government instituted some experiments at Meudon, under Guyton de Morveau, Coutelle, and Conté. The following year a regular balloon corps was formed by a decree, of which the following is a translation:—"Considering the report of the experiments made at Meudon of a balloon carrying observers, the Committee of Public Safety, wishing immediately to make use of this new machine for the defence of the Republic, which presents such valuable advantages, resolved upon the following:—

"1. A company bearing the name of *aërostiers* will be formed immediately, for the employment of a balloon to belong to one of the armies of the Republic.

"2. It will be composed of a Captain, a sergeant-major, who will at the same time act as quartermaster, 1 sergeant, 2 corporals, and 20 men, half of whom at least will be experienced in the trades necessary to this service, such as masonry, carpentry, painting, chemistry, &c.

"3. The company shall resemble, in composition, organization, and payment, other companies, and will receive the same field allowance as other troops.

"4. The uniform to be, coat, waistcoat, and trousers, blue; braid, red; collars and facings, black; buttons as infantry; with trousers and jacket of blue linen for fatigue duties.

"5. The armament of the said company shall consist of a sword and two pistols.

"6. The citizen Coutelle, who has hitherto directed the operations ordered by the Committee on the subject, is nominated Captain of the said company, and is charged to recruit at once anyone he may consider capable of filling the different ranks.

"7. As soon as the company is formed, and even before it is complete, those who have been admitted shall go at once to Meudon in order to be practised in the work relative to this art.

"8. The company of *aërostiers*, during the time they are with the army in the field, shall be entirely subject to military discipline; and under the orders of the Commander-in-Chief. As to the expenditure, it will be taken out of the funds of the Commission of Arms and Ammunition, who will forward the necessary amount to the sergeant-major, and will receive the accounts.

"Signed, &c.,

"*Members of the Committee of Public Safety.*"

Several balloons were made by these *aërostiers* of specially manufactured Lyons silk, and were so efficiently varnished that they were said to have remained inflated for two or three months. The first was the "Entreprenant," 27 feet diameter. It could support about 500 lbs., and 10 to 20 lbs. of ballast were taken in the car. The balloons were held captive by means of two cords, fastened to the equator by network, so as to prevent their turning about (which is always detrimental to balloon observation), and which allowed them to rise about 1,500 feet.

For transporting the balloon, twenty cords were fixed to the equator

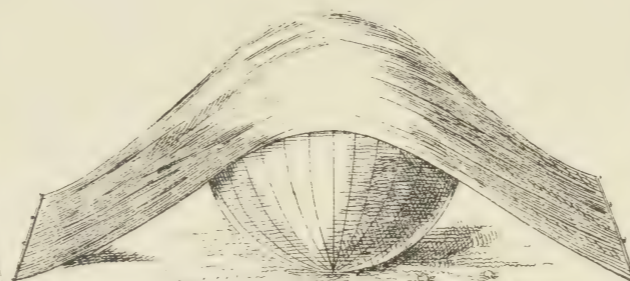
Apparatus for making Hydrogen.

Scale of Feet.
5 4 3 2 1 0 5 10 15

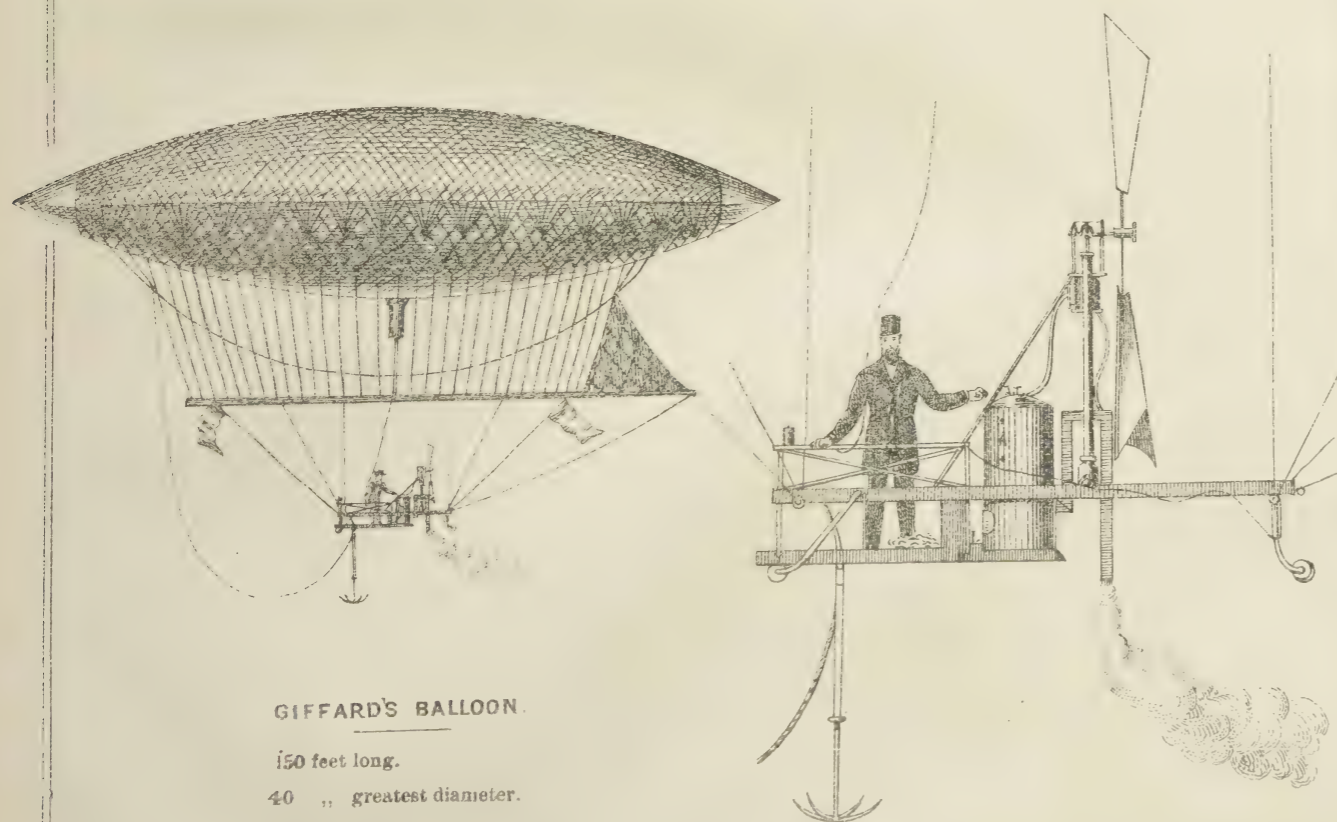
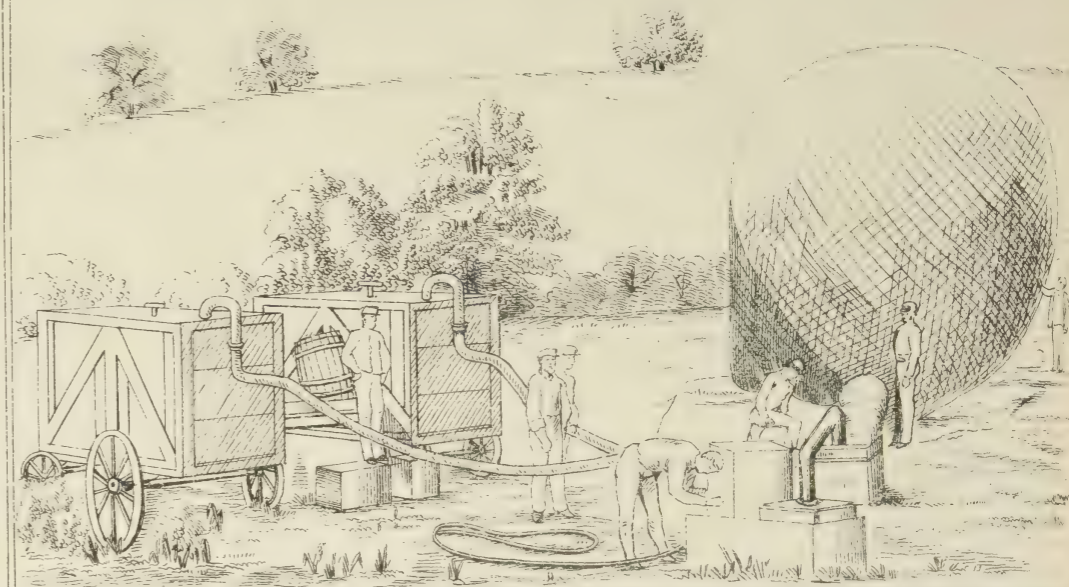


FRENCH WAR BALLOON, 1793.

(Balloon under cover.)



AMERICAN WAR BALLOON, 1863.

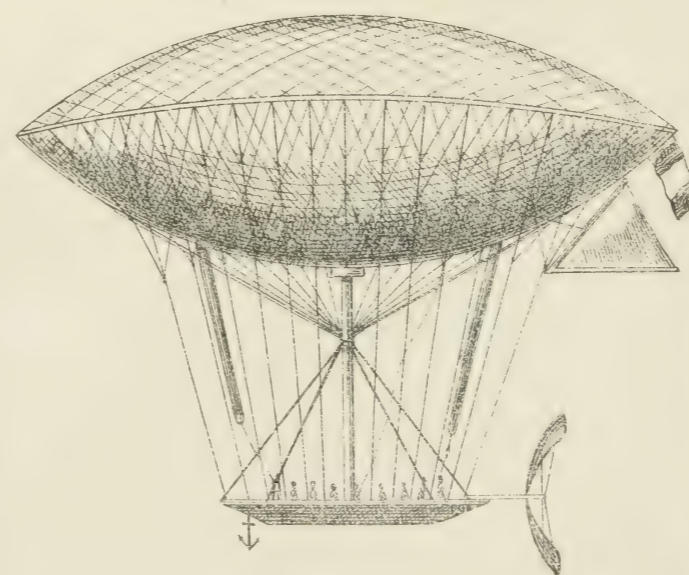


GIFFARD'S BALLOON.

150 feet long.

40 " greatest diameter.

Screw 12 feet across.

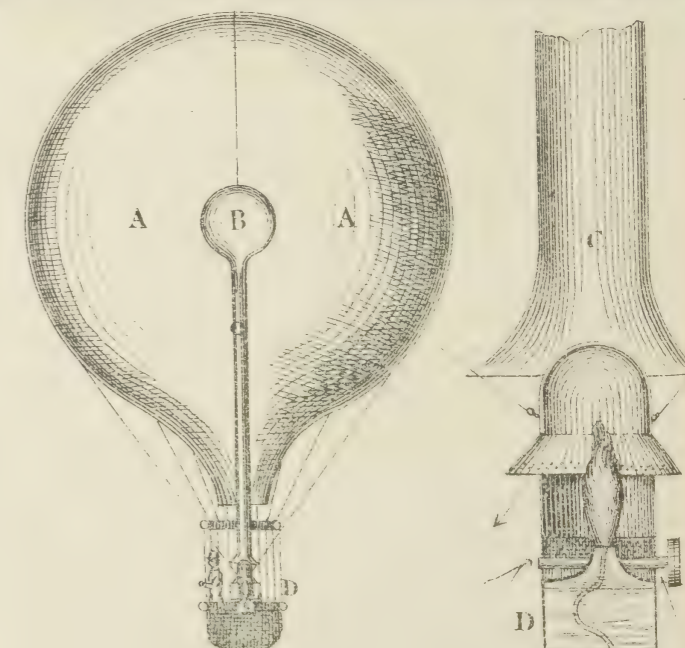


DE LÔMES BALLOON.

117 feet long.

48 " greatest diameter.

Screw 30 feet across.



REGULATOR OF TEMPERATURE.

EXPLANATION.

- | | |
|-----------------------------------|-------------------------|
| A Ordinary gas balloon (Section). | C Gas-tight pipe. |
| B Small balloon (perhaps metal). | D Stove or spirit lamp. |

When the stove D is lighted, the air in the tube C and chamber B is heated, which causes the surrounding gas in A to be raised in temperature, the lamp can be turned up or down, or the pipe C removed, so that the gas can be heated or cooled as required, and the balloon thus caused to rise or fall.

If balloon contains 25,000 c. ft. and the temperature within it be raised 1° the Gas would expand $\frac{1}{273}$ of 25,000, i.e., 50 c. ft., which would be equivalent to displacing 50 c. ft. of air, or to discharging 3.8 lbs. of ballast.

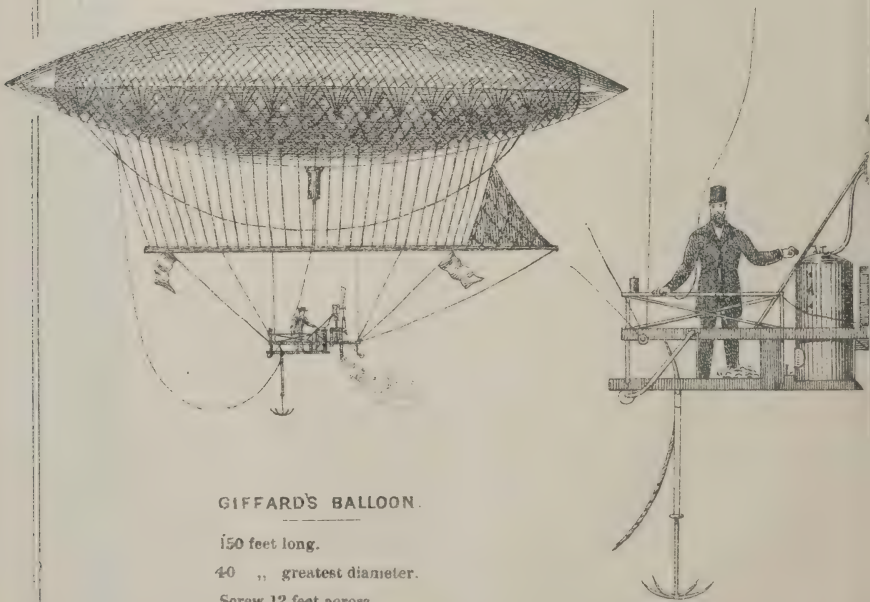
Apparatus for making Hydrogen.

Scale of Feet.

5 4 3 2 1 0 5 10 15



FRENCH WAR BALLOON, 1793



GIFFARD'S BALLOON.

150 feet long.

40 „ greatest diameter.

Screw 12 feet across.

by triangular pieces of netting to equalize the strain, and one man was told off to each cord to tow it along. At night it was snugly secured under a large piece of sailcloth. (See Plate.)

A difficulty was experienced in the production of hydrogen gas, as the authorities refused to allow it to be made, as usual, from sulphuric acid, all the sulphur obtainable being required for the manufacture of gunpowder.

Guyton de Morveau, however, suggested a convenient method invented by Lavoisier, of producing hydrogen from steam passed over red-hot iron, and a furnace was built which, after many trials, was capable of producing sufficient gas to fill the balloon in four hours.

Communication with those on earth was kept up by means of signalling with red, white, and yellow flags, similar ones being laid on the ground for answering, and also by notes thrown overboard, tied to little sand-bags, or to loaded arrows, which stuck upright in the ground.

The balloon "Entreprenant" was sent to General Jourdan of the Army of the North, the "Celeste" to the Army of the Meuse-Sambre, and the "Hercule" and "Intrépide" to that of the Rhine-Moselle. Coutelle built a furnace for gas-making near Maubeuge, and on June 18th made an ascent and very successfully reconnoitred the Austrian position. It is a noteworthy fact that this balloon, with the same filling, was serviceable at Namur till July 16th, when it got torn during a storm. During this period it underwent many trials. Constantly the enemy fired at it, its position being noted, and guns were brought to bear on it while low down, ascending or descending. It was taken from Maubeuge to Charleroi, a distance of about 30 miles, towed across country by twenty men, floating at such a height as to permit cavalry and other troops to pass beneath. At the Battle of Fleurus, two ascents were made, each of about four or five hours, notwithstanding a strong wind. All the movements of the enemy were observed and reported. The balloon had a great moral effect on both sides, and the success of the French at this battle is said to have been greatly due to the aid of this balloon. It was found to be preferable to attach the cable to horses or men, rather than to fixed objects, as the strain on the balloon was thus considerably lessened.

So successful was this performance considered, that a second company of aëroliers was formed, to serve as a sort of dépôt at Meudon, men and material being sent to the front as required.

During the siege of Mainz in 1799, Coutelle made some ascents during a very strong wind. Of this occasion he writes: "I was at more than 1,000 feet from the ground, when three successive squalls knocked me to the ground with such force that many of the bars that strengthened the bottom of the car were broken. On each occasion the balloon rose with such force and rapidity that thirty-two men at each rope were dragged some distance. It is therefore clear that had the ropes been fixed to anchors they would have broken." He, nevertheless, managed to count the number of the enemy's guns. The Austrians even went to the length of sending out a flag of truce

to request Contelle to descend from his perilous situation. This shows that balloon reconnaissance is possible even in a very high wind.

The balloons also made ascents at the battles of Ehrenbreitstein, Aldenhove, Liège (when an English General, Money, was a witness of the event, and spoke in most favourable terms of it), Bonn, Andernach, Frankfort, and Wurzburg (where the company were taken prisoners).

In October, 1795, an *aéronautic* school was established at Meudon, composed of sixty pupils, who were instructed in all details of the construction and management of balloons as well as in all scientific subjects relating thereto.

In a report to the National Convention (1795), the balloon is described as "a new instrument of war which our enemies have recognized as the pioneer to victory," and the report adds "soon all our armies will have complete *aërostatic* companies, with tents and rigging, which will be as necessary to them as parks of artillery." But General Jourdan did not speak encouragingly of them.

In 1798, Napoleon took a balloon equipment with Coutelle, Conté, and Plazenet to Egypt, but unfortunately for them, the English managed to capture the ship which contained the apparatus. After this the "*aërostiers*" seem to have gradually died out of notice, and the corps was dissolved, and the balloons sold in 1804. It is said that this was due more immediately to the displeasure of Napoleon at the performance of a balloon which ascended at his coronation, with a large crown suspended beneath it, which travelled all the way to Rome, and deposited part of its crown on the tomb of Nero.

In 1812, the Russians constructed a huge balloon at Moscow, to carry fifty persons, which was to hover over the French Army and rain forth shells and explosives. But their expectations rose higher than their machine, which refused to move off the ground. A balloon reconnaissance was made at the siege of Antwerp in 1815. In 1826 the subject was again mooted by the French, and a balloon was sent to Algiers, but it was never disembarked. The Russians are said to have tried experiments with a balloon at Sebastopol.

The French again used balloons in the Italian Campaign of 1859. They employed the civilian *aéronant* Godard, and the results seem to have been decidedly unsatisfactory at first, but a useful ascent was made the day before Solferino in a fire-balloon. A few days too late a properly constructed gas-balloon arrived. This balloon was inflated at Milan, taken a distance of 20 miles, and then remained for two days "without suffering any perceptible loss of gas." Nadar, another French *aéronant*, used a private balloon at Solferino, of 30,000 cubic feet, from which he hoped to take photographs of the battlefield. It was said to have retained its gas and lifted three men after one month. Some reconnaissances were also made in it. A correspondent asserts that the whole $2\frac{1}{2}$ miles of front of the Austrian position was clearly seen.

When the civil war in America broke out, several balloons were used in the operations. On October 4th, 1861, an *aéronant* named La Mountain ascended in a balloon from McClellan's camp on the Potomac.

He cut the retaining rope and ascended to a height of $1\frac{1}{2}$ miles, when he drifted over the enemy's lines. "Here he was enabled to make a perfect observation of their position, and all their movements." He then rose into another current of air and returned, and descended safely within his own lines. The results which he communicated to headquarters were declared to be "of the utmost importance."

Later on the Federals instituted a regular balloon corps, of which Colonel Beaumont, R.E., has written an interesting account in the Royal Engineer Professional Papers. The balloons were of two sizes, one of 13,000 cubic feet capacity, the other double that size, but the large size was found most suitable. They were made of the best silk, the upper part being composed of three or four thicknesses, carefully varnished with light grey varnish, and capable of retaining sufficient gas for an ascent a fortnight after inflation. Three guys, one of which passed through a snatch-block attached to a tree or other fixed object, held the balloon captive at a height of about 1,000 feet.

Hydrogen gas was used for inflation. It was generated from old scrap iron and sulphuric acid, in a portable apparatus carried on two carts. The iron and acid were mixed in tanks made of wood lined with metal, the gas afterwards passing through lime water. Little more than three hours were required to set up the apparatus and fill the balloon. Two balloons and two generators were taken each on four-horsed wagons, and one two-horsed acid cart. The detachment consisted of one chief aëronaut (Mr. Lowe), one Captain (who never ascended), and about fifty non-commissioned officers and men. The balloon accompanied the advanced part of the army, so as to be useful in reconnoitring, twenty-five or thirty men towing it by cords at a convenient height. Unfortunately the country round Richmond, being thickly wooded, was most unfavourable for balloon reconnaissance, but many valuable details were discovered. Earthworks could be distinguished at a distance of 8 miles, while the piquets and supports of the enemy were distinctly seen. A telegraph wire was sometimes attached to the balloon, so that the aëronaut could at once communicate to the General, or even, as was done one time, to the Government at Washington. Some photographs were also successfully taken of the enemy's position.

The aëronaut and the General each had maps, similarly divided into small squares, which were numbered, whereby the communications were simplified.

On one occasion General Porter ascended, but the cable broke! (owing, it is said, to acid being accidentally spilt on it); he descended, however, within his own lines. "Major Colburn accompanied Professor Lowe in his voyage and made a sketch of the enemy's country that was so correct that Virginians who were familiar with the vicinity of Fairfax Court House at once recognized it, and named the roads, lanes, streams, and houses."¹

The "Times" correspondent says of the Battle of Chickahominy: "During the whole of the engagement, Professor Lowe's balloon

¹ Putnam's "Records of the Rebellion."

hovered over the Federal lines at an altitude of about 2,000 feet, and maintained successful telegraphic communication with General McClellan at headquarters. It is asserted that every movement of the Confederate armies was distinctly visible and instantaneously reported," and later that "a balloon reconnaissance from Falmouth had disclosed the fact that a considerable portion of the Confederate Army had left Fredericksburg." In an attack on Mississippi Island Number Ten, Engineer-Aéronaut Allan ascended, and directed the artillery fire, communicating the effect of each shot. Balloon reconnaissances were made during May and July, at the bombardment of Yorktown, also at Fair Oaks, but this balloon fell into the hands of the Confederates shortly after.

In July, 1862, the first military balloon experiments in England took place at Aldershot. The aéronaut, Mr. Coxwell, was employed to bring one of his balloons which was filled at the gasworks and made many captive ascents, the highest being 2,200 feet. Colonel Beaumont said that "no large movement of troops could take place within a radius of 10 miles without being seen." Later on, some more experiments were made, a 1-inch wire rope being used as cable.

In the war in Paraguay in 1866, a balloon was used at Tuguli. It was managed in much the same way as the military balloons on the Potomac, and the General commanding says he "made from it several very important observations."

When the war between France and Germany broke out, Coxwell went to manage some war balloons for the Germans. He formed two companies (2 officers and 42 men) at Cologne, and made some observations at Strasburg; but such a system was not satisfactory and but little good was done.

During the Siege of Paris, balloons, it will be remembered, were made use of in a more regular and extensive manner, and with most important results. At first two old balloons were anchored at Montmartre and Montsouris as observatories to watch the Prussians. They apparently accomplished but little, although one or two new ideas were introduced. The messages from the balloons were put in a little box which was attached to the cable by a ring, so that the observations were delivered straight to those who held the rope. Every twenty-four hours six ascents were made, four by day and two by night, the latter to observe the camp fires, &c., and it was proposed to use a search electric light.

When the Parisians found themselves cut off from all communication with the outer world, balloons were naturally suggested as a means of escape. Several experienced aéronauts were in Paris, as well as a few balloons. The first aéronaut left Paris in an old leaky machine, which soon came down, but just beyond the Prussian lines. The second took some carrier pigeons to convey back news. M. Godard had two small balloons, neither sufficient for the purpose of escape; but he fixed one below the other, and made a very successful voyage in the "Etats-Unis." The fourth was the last ready-made balloon in Paris, but the success of the employment of the aerial

highway was established, and the Government ordered a number of new balloons to be at once constructed. The chief railway stations, now no longer used as such, were converted into balloon stations and manufactories, and were remarkably suitable for the purpose. The balloons were made of strong cambric, oiled, and of about 70,000 cubic feet capacity, and cost about 160*l.* each. They were filled with coal-gas, and could carry a load of 2,000 lbs., including 600 lbs. of ballast and about 1,000 lbs. of despatches. The first of these, the "Armand Barbés," bore Gambetta beyond the clutches of the Germans. I need hardly refer to the important political consequences of this balloon voyage. Then followed numerous other ascents; one balloon travelled all the way to Norway; another landed on Belle Isle, with a strong east wind blowing. Many were fired at, but few injured. Three balloons fell into the hands of the enemy near Paris, and two in Germany, while one private balloon, with the best intentions, failed to travel even as far as the Prussian lines. Two balloons, each manned by one sailor, were carried out to sea and lost. The average distance travelled was about 180 miles, and the speed varied from 7 to 50, and in one instance, 80 miles an hour. During four months 66 balloons left Paris, of which 54 were specially constructed for the Administration of Post and Telegraphs. About 160 persons were carried over the Prussian lines. Nine tons of despatches, or 3,000,000 letters, were successfully conveyed to their destinations. 360 pigeons were taken up, of which, however, only 57 returned to Paris, but these conveyed nearly 100,000 messages. Of the aëronauts in charge only 12 were professionals, the remainder being chiefly sailors and acrobats.

In June, 1871, the English Government appointed a Committee consisting of Colonel Beaumont, R.E., Lieutenant Grover, R.E., and Sir F. Abel, to enquire into the use of balloons for warfare.

In 1878, Giffard made his great captive balloon for the Paris Exhibition. Although it had no immediate military purpose, a few words upon this marvellous work of art may not be out of place, as showing how successfully a very large balloon may be made, retained captive, and kept inflated under perfect control. It was spherical in shape, 118 feet in diameter, containing 882,900 cubic feet, so that it was capable of raising, when inflated with hydrogen, 27 tons. The car was constructed to hold 52 persons. The cable was a hempen rope 2,000 feet long, tapering from 3·3 to 2·5 inches diameter. A steam-engine of 300 horse-power was used to haul it down, by the means of a large windlass, to which an automatic pneumatic break was applied to prevent sudden jerks. The material of which this balloon was made consisted of seven different layers, of muslin, india-rubber and canvas, put on alternately. The seams were covered with strips of the same materials and were sewn together with 31 miles of strong thread. The outer surface was varnished and painted white. The netting also was of peculiar construction, for, instead of knotting it together, the cords (which were $\frac{1}{2}$ inch diameter) were passed across one another and bound with leather. The lower part of the net was connected by small pulleys so as to equalize the strain. A circular

building had to be specially constructed wherein to manufacture this great aerial ship. The balloon was inflated with hydrogen, produced by sulphuric acid and iron; 190 tons of acid and 80 tons of iron being consumed in the process.

In April, 1879, the English Government instituted an official Balloon Committee, consisting of Colonel Noble, R.E., Sir F. Abel, and Captain Lee, R.E., with whom were associated Captain Elsdale, R.E., and Captain Templer, of the Middlesex Militia, the last mentioned having had considerable experience in ballooning.

Experiments were conducted at Woolwich, and four balloons were made by the Royal Engineers of specially woven fine calico, varnished. A portable furnace and boiler for the manufacture of hydrogen gas was devised similar in principle to the one used by the French in 1793, but with steel sides covered with tiles, and the whole balloon equipment could be carried in three general service wagons. The hydrogen was made by passing steam over red-hot iron turnings, the entire filling apparatus, which had six vertical cylinders, weighed $3\frac{1}{2}$ tons, and was capable of generating sufficient gas for two balloons in twenty-four hours. But the apparatus did not prove satisfactory.

Only a few days after the first experiment an unforeseen adventure happened to a balloon as it was being towed, attached to a cart. The cable snapped and the balloon disappeared in the clouds!

In October one of the balloons was tried free at a review on Woolwich Common, but the wind was unfavourable. The next year the "Crusader" figured at the Brighton Volunteer Review. Captain Elsdale and Captain Templer and nine men managed the balloon. It contained 25,000 cubic feet, and was inflated at the Lewes Gas Works, and towed $2\frac{1}{2}$ miles across country, crossing a tidal river and a railway with telegraphic wires, &c. Two small balloons of 1,500 cubic feet was taken as a reserve supply of gas. The balloon then ascended to a height of 1,500 feet, the mist of the morning and the smoke from some burning furze obstructed the view at first, but later on the weather cleared and a splendid view of the operations was obtained, every man being clearly seen. Finally the balloon "marched past," attached to a four-horse wagon, and then retired at a gallop and returned to Lewes.

In September, 1880, the War Office detailed a whole company of Engineers (the 24th) for instruction in ballooning at Aldershot, and many experiments were made.

Meanwhile, in 1872, the French Government had again determined on establishing a military aeronautical school, and Meudon was again the scene of ballooning experiments. An annual grant of 10,000*l.* was made, and 150 men of the Engineers told off to assist. Since then the establishment has increased, four complete units of ninety men having been formed, each with its own balloons, a portable steam lowering apparatus, and all appliances. The greatest secrecy is kept, and no strangers are admitted to the enclosed premises. Here a large building is erected, capable of holding several inflated balloons, which can be removed at one end. There are numerous other buildings, and plenty of space for experiments. The balloons

are spherical, 10 metres diameter, made of the best silk, and covered with a special varnish, which renders them so gastight that they can remain inflated for a month.

It was proposed to make forty balloons, and it is said that twenty have already been made. The hydrogen apparatus can liberate from 3,500 to 7,000 cubic feet per hour. A liquid which does not readily freeze is used as ballast, so that the discharge can be nicely regulated. A sort of iron harrow is used as anchor, as well as grapnel, when descending in free balloons. For captive ascents a kite-screen is attached to the guy-rope, and communication is kept up by telephone.

English military ballooning received a sudden check when the unfortunate accident occurred to the War Office balloon "Saladin," in December, 1881; but when the Egyptian Campaign commenced it was proposed to send out a balloon equipment to the seat of war. Delays occurred, however, and the decisive battle was fought ere the balloons left England. Four Officers were to have accompanied the three balloons, of 27,000, 18,000, and 13,000 cubic feet respectively. It is greatly to be regretted that they were not sent out sooner, although, as it happened, they could hardly have shortened the war much; but Egypt is a country particularly favourable to their employment, being so flat and open, with few trees, and a steady wind, that much valuable experience would have been acquired, irrespective of the more direct advantages, of knowing beforehand the strength and disposition of the enemy behind the Kafr-dawr and Tel-el-Kebir lines.

(3.) *Causes of Success and Failure.*

Having thus glanced at the history of Military Ballooning up to the present time, I will now discuss some of the causes both of success and of failure, after which I will mention a few suggestions for improvements.

It seems that whenever a regularly organized and specially prepared balloon equipment has been employed, it has proved satisfactory. The French "aëroliers" of 1793 really did very useful work; and there is no better proof of this than the way in which the Government increased their numbers. The Americans in 1862 did well, notwithstanding the very unfavourable nature of the country. The Paris balloons of 1870-71 were most successful on the whole, and their employment was of the greatest importance.

For reconnoitring purposes, it is at once apparent that more than one balloon is necessary for efficient observation. It is too much for one man to note the complicated masses of troops moving in various directions and to signal or write down his messages in time. Either two or three men should be observing out of one balloon, or what is better, there should be several balloons at different parts of the field, which could all be filled at the same filling apparatus, and the whole thing done on a more extensive and more systematic plan.

Major Grover, in a very interesting article on this subject in the Royal Engineer Papers, 1863, mentions the following objections which

have been raised to the employment of balloons in war. 1. The chance of being wrecked by projectiles. 2. Difficulty of transporting the apparatus. 3. Difficulty of providing gas. 4. Difficulty of obtaining good trained *aéronauts*; and 5. Dangers of ballooning. Several other difficulties have also been spoken of, such as 6. Obstruction of view by smoke or otherwise. 7. Difficulty of management in rough weather, and motion of balloon unfavourable to observation.

(1.) First, then, the chance of being wrecked by shots from the enemy. It must be remembered that the balloon would generally be some way behind the first line, and that the enemy would hardly, especially during the heat of a battle, pay much attention to it. It is well to remember that, if only hit by a few bullets, it would not be much damaged and could be very quickly repaired. Both at Frankfort and at Frankenthal the balloons were penetrated by bullets, at the latter place by nine, but the balloon remained up three-quarters of an hour after. In some experiments made at Tours, a balloon was penetrated by bullets at 1,000 yards, but the escape of gas was very slow, and the balloon remained up some time longer.

Again, in 1880, the Siege Operations Committee made an experiment at Dungeness with rather more disastrous results for the balloon. An 8-inch howitzer was directed on a captive balloon, 2,000 yards off, and 800 feet high. The first shot was unsuccessful, the exact range not being known. The second shell, however, burst just in front of the balloon and tore it open. But even then the balloon took fifteen minutes to descend, so that the *aéronauts* would have been safe. This balloon was, however, only 800 feet above the earth, had it been 2,000 feet up, as it might be when facing hostile guns, it is doubtful if it could have been hit.

Bullets made of spongy platinum have been suggested as a means of igniting the hydrogen in a balloon by mere contact.

(2.) In regard to the other difficulties, the transport has been so simplified that balloon accessories and filling apparatus can be carried on one or two wagons.

(3.) As for the difficulty of providing gas, I think great stress may be laid on the fact that balloons can remain inflated for a long time. We have already seen that this has been done not only experimentally, but actually in the field, the old *Fleurus* balloon having remained full for a month, making continual ascents, being transported from place to place, and undergoing all the rough usage and hardships of war. So that once filled they may be taken miles away from their filling apparatus, and used day after day, thus still more simplifying the transport. The manufacture of gas will be referred to presently.

(4.) As for trained *aéronauts*—although it is, of course, preferable that there should be several to each balloon, and that they should be thoroughly efficient—I may say that it is not an *absolute* necessity that an *aéronaut* should be a civilian, or that he must be trained to the work from his birth; any Officer or man can soon learn the work. We have a good instance of this in the Paris siege balloons. When we reflect that out of the sixty-six balloons, fifty at

least were managed by men who had probably never been in a balloon before, it seems surprising that more did not come to grief. It is curious to note the way in which these men were trained, or rather, given lessons. Some cars were suspended from the roof of the railway stations, in which they were put, told to imagine they were floating in the realms of cloudland, and then directed to pull the imaginary valve-line, &c. It was, as Captain Templer aptly remarked, like learning to swim on dry land. I am sure they would have learnt much more by taking out small balloons into the open air and observing the results of altering ballast, and the effect of the wind on them.

It would always be best to have a good draughtsman trained to the work, as one unaccustomed to it might not feel quite "at home" in the balloon, besides which he would not be able to judge of the features of the ground, which have so peculiar an appearance from above.

(5.) Then as to the danger of ballooning. This is generally much exaggerated. I have elsewhere pointed out that the deaths which have occurred are not more than one to every 1,000 ascents, and that good aëronauts have made over 1,000 ascents without accident. But it is a noteworthy fact how many of the accidents have occurred from one single cause, viz., passengers being thrown or jumping out of the car on concussion with the ground when descending during a strong wind. The unfortunate "Saladin" affair was principally due to this cause, and since then the accident to Sir C. de Crespigny, another to Mr. Simmons, and only a few months ago to a man who was killed in Spain, besides many, indeed nearly all, previous severe balloon accidents, may be ascribed to this one cause.

It seems to me that this fruitful source of misadventure can easily be remedied. It is necessary to prevent the possibility of people leaving the car—whether intentionally, ignorantly, or accidentally. A sort of network placed round the "car-lines" would have this effect, a "doorway" might be left in one side, but I feel sure that in nearly all cases it is best to remain with the balloon, and I believe that such measures would be the means of preventing many accidents.

Another arrangement which might often prove of the greatest value, but which is seldom if ever used in England, is a "tear-rope," so that on emergency a balloon may be torn right up, and thus stopped at once, without any dangerous dragging across country. Although I have never seen a tear-rope tried, I have experienced a balloon being split up on descending in a wind, and at once emptied of gas.

But this applies more to free balloons, whereas in war free ascents would probably be of comparatively rare occurrence, and captive ascents are of course much safer.

(6.) I have myself noticed that the smoke from guns does not impede the view, except perhaps on a very calm day, as much as might be thought. It only exists in front of the guns or line of troops, just where no other troops would be, so that it merely helps to indicate their position to those who can observe from above.

(7.) I think the best proof of the possibility of employing balloons in all but the roughest weather is the fact already noted of the French war balloons of 1793 remaining inflated and making ascents in a very strong wind. At the last Brighton Volunteer Review, 1883, I made some captive ascents during a very strong south-west breeze, and although, owing to insufficiency of buoyancy, no great height was attained, yet I was enabled to obtain a very good view of the field of operations, and was tossed about much less than might have been expected. Indeed, the wind at a good height above the earth would probably always be steadier, and not so gusty as on the ground. On this occasion I was able to use field-glasses quite well.

(4.) *Captive and Free Balloons.*

War balloons may be employed either captive or free, with or without aëronauts.

Captive balloons are no doubt all round the most suitable for war purposes. They are independent of the direction of the wind, can remain for hours in one spot, can be hauled down without loss of gas, and communications easily kept up by notes, telegraph, signals, or telephone. A strong wind is the great enemy to a successful captive ascent, not merely because of the strain on the retaining rope and material, but also because the balloon must have a very great ascensional force to rise, as the wind will, of course, have a tendency to blow it as far as possible to leeward of the point of retention, and therefore downwards. I have found a balloon, capable of ascending to a considerable height when free, hardly able to rise a few feet when held captive, and liable so continually to be blown violently against the ground if the weather be rough.

For this reason the balloon should present as small a surface as possible to the action of the wind. A long cylindrical shape has been suggested as best for this purpose. The French, in 1793, made one of this kind, but apparently it was not very successful. Such a balloon would also possess other advantages over the ordinary spherical shape. It may be filled and kept sheltered from the wind and out of sight and fire of the enemy. It would be easier to transport in a wind or through forests, &c. It could be towed better and would be steadier for observation. But it has the great objection that if the balloon were not quite full of gas, and therefore stiff, the end would be blown in, and offer great resistance to the wind. It might perhaps be stiffened by a framework in front, or, by various means, it could be kept fully inflated. There need be no limit to the length, except the difficulty of suspending the car and the additional weight of material.

A balloon possessing the above advantages might even be used as a means of transport. We have a recent instance of how desirable a canal may be. The air might be navigated by a long balloon, just as a canal is by a long canal boat, in certain circumstances where strong winds are rare and means of communication bad.

Captive balloons could also be used, both by day and night, for

communication, by mooring two or more at intervals, of even 20 or 30 miles in favourable weather, and signalling from one to another.

Small balloons retained by a string have been employed for taking plans of the country beneath by instantaneous photography, an electric wire connecting the apparatus with the ground. Several tolerably intelligible photographs have been taken in this way, and with the improvements which will come with experience, good and rapid automatic surveys of fortifications, &c., may be made; the great difficulty would be to get the balloon over the right spot, or focus the camera in the required direction. Experiments have recently been made in this line, both in the French and German Armies, as well as by Captain Elsdale, R.E.

Small captive balloons, without passengers, have also been used as signals. In the night fight at Kaiserlautern in 1794, lighted signal balloons were employed. Mr. Coxwell has also demonstrated their use. They could be made to take up a search electric light, and they have been proposed as a means of dropping shells into a besieged town, and for many other purposes. The chief advantages thus gained are, a smaller balloon, which is easier to hold down, not so bulky to transport, does not require so great a quantity of gas, is less liable to be injured by the fire of the enemy, and no danger to aëronauts.

Free balloons have the advantage of requiring much less ascensional force than captive balloons, because they have no weight of rope to carry, and no wind to withstand. They are also much steadier when up, and not so liable to be hit by shot; they are very dependent on the direction of the wind, but ascents can always be made. If the wind blow parallel to your front the balloon may be taken to windward, and allowed to travel right down the line. If the wind blows towards the enemy the ascent should be some way back, rapid observations taken, and the descent effected just within your own lines. If the wind blows away from the enemy the process should be reversed. The balloon could always be towed back to the starting point to repeat the ascent. In some cases it would be possible to sail right over the enemy's position, signalling or sending by carrier pigeons all the information you obtain, and descending when you get to friendly climes. In this way most valuable information might be gathered. Finally, adverse currents of air may be made use of, as we have seen was done in the American War; this, although rather risky work, is not so much a matter of chance as many may think. In ordinary balloon pleasure trips taking trouble to reach any particular place is seldom attempted, but when special ascents have been made with this object the results have often been successful. Captain Templer has travelled intentionally from the Crystal Palace to Barnet, another time from the Crystal Palace to Aldershot, another time from Southall to Harrow.¹ Captain Elsdale has also travelled from Woolwich to Colchester by using three different currents of air. A small "satellite" balloon, weighted as required and retained by a fine line, say 1,000 feet long, is useful for ascertaining the direction of neighbouring currents of air.

¹ "Templer on Military Balloons," see Journal, vol. xxiii, No. XCIX, 1879.

Small free balloons without passengers have already been tried in war. In 1793 the garrison of Valenciennes or Condé sent off one with despatches attached, which, however, fell into the enemy's camp. In June, 1849, the Austrians made 200 small balloons, each to carry a bomb of 24 to 30 lbs., furnished with a time-fuze. These were to be drifted over the besieged town of Venice; but either the wind changed or the upper currents of air were not favourable, and many of the balloons came back over the assailants, without, however, doing any damage. At Metz, in 1870, a much more successful result was obtained by some artillery Officers, whose balloon travelled to near Neufchâteau, and the despatches which it bore were forwarded to Paris. Shortly after, a small balloon was found in Surrey with letters attached, which proved to have come from besieged Paris. Captain Jones, R.E., has lately been experimenting with balloons of this class.

This system of employing balloons is really one of the simplest imaginable, especially if they be on the hot air principle. A few might always be taken with an army or detachment, and, although communication by their means is not a certainty, yet if three or four balloons with cypher messages were sent up during a favourable wind, with a time-fuze regulated so that they would fall in a given time, according to the strength of the wind, there is great probability of their proving invaluable in case of other means of communication being cut off.

My father, the late Professor Baden-Powell, suggested small balloons for scientific use with the fatal Polar Expedition of Sir John Franklin, and I have a letter from the latter regretting he had not then time to prepare them. Later on, when Sir James Ross was sent out on the search expedition, balloons were utilized, and Sir Leopold McClintock has kindly given me the following interesting particulars of them:—"Balloons were first used in the Arctic regions in 1850, in the Arctic searching expedition under Captain Horatio Austin, for the purpose of distributing papers containing information of the whereabouts of our ships, and the depôts of provisions formed by them for the relief of the missing expedition. These printed coloured papers were tied in little bundles to a slow match which was attached to the balloon—perhaps a dozen bundles of a hundred papers each, as the slow match burnt, the bundles of notice papers were gradually set free. Forty-two balloons were taken; they were of silk, 3 to 5 feet diameter, and the total cost was 164*l*. They were inflated with hydrogen gas, generated by means of sulphuric acid and granulated zinc. Similar balloons were also used in the searching expeditions in 1852-3-4."

(5.) *Means of Inflation.*

One of the greatest difficulties encountered in ballooning on active service is the means of inflation.

The principle of the ascension of a balloon is the rendering its contents lighter than the displaced volume of air. This may be accomplished either by filling with a lighter gas, such as hydrogen or coal-gas, or by heating the air inside so as to make it expand, and

thus make a smaller quantity, and therefore less weight, of air to fill the same space. So that in order to rise, the weight of the air (76 lbs. per 1,000 cubic feet) displaced by a balloon of given volume must be greater than the total weight of the balloon, contents, and all accessories.

Hydrogen is the lightest gas known, and for this reason is the most suitable for inflating balloons, as a smaller quantity of the gas is required, and the capacity of the balloon may consequently be less, and its reduced size has the advantage of offering less resistance to the wind. The objections to the use of this gas are that it is more expensive, and being more subtle, is harder to retain, than coal-gas. Its rate of diffusion is about $2\frac{1}{2}$ times greater than that of coal-gas.

Pure hydrogen is $14\frac{1}{2}$ times as light as air, but when made on a large scale $\frac{1}{6}$ to $\frac{1}{10}$ the weight is generally calculated on. So that 60 to 70 lbs. may be taken as the lifting power of 1,000 cubic feet of hydrogen.

The most usual method of obtaining hydrogen, that used during the American War, is by means of the action of dilute sulphuric acid on iron or zinc. It is simple, and requires but little apparatus. One cubic foot of hydrogen is produced by mixing 4 to 6 oz. of acid with about 20 oz. of water, and putting in 4 oz. of iron scraps. Thus 250 lbs. of iron are required to produce 1,000 cubic feet of hydrogen. Zinc does not give off so much, but the gas is purer and therefore lighter. Steel gives rather more gas than iron does. The gas thus produced costs about 17. 5s. per 1,000 cubic feet. (Sulphuric acid costs about 5s. 6d. per cwt.) I saw a good portable apparatus on this principle tried in Paris, when a balloon of 6,000 cubic feet was filled in four hours. It was said to be capable of generating 3,500 cubic feet in 50 minutes with one charge. The acid is forced into the vessels by means of a hand pump, which compresses the air in the carboy, and drives out the acid. The generating vessels are of iron lined with lead.

Another method of producing hydrogen is by the action of steam on red-hot iron. This process gives a much lighter gas. Iron turnings are put in tubes (preferably of brass, on which the steam has little effect). These are made red hot in a furnace, and a current of steam is sent through the tubes from a boiler. The oxygen of the steam combines with the iron and the hydrogen is liberated, and is passed through a purifying and cooling bath of lime water. The apparatus used by the French in 1793 was on this principle (see Plate); it consisted of seven pipes of cast iron, 3 metres long, by 3 decimeters diameter, each filled with 200 kilogrammes of iron turnings rammed into the tubes; 1 lb. of water was thus converted into 16 cubic feet of hydrogen. Our own engineers have adopted this method, for which but little material is required, iron scraps being abundantly met with in any village or battlefield; but the process is slow and difficult. Giffard suggested passing steam over heated carbonic oxide and native oxide of iron, by means of which the gas could be produced at 6s. per 1,000 cubic feet. Hydrogen may also be obtained by passing steam over red-hot charcoal or coke, which does not require so great a heat, but gives a much heavier gas.

About the most simple and rapid method, although practically useless on account of its expense, is the placing a piece of sodium in water, when about 700 times its volume of hydrogen is at once given off. But as the metal at present costs as much as 5s. per lb., 1,000 cubic feet of gas would cost 22*l*.

Hydrogen may also be obtained by passing a current of electricity through water, which is thereby decomposed into hydrogen and oxygen, and a small steam-engine might then serve the two purposes of decomposing water and winding the cable.

Coal-gas, such as is used for lighting, is much more convenient for ordinary balloon purposes. It is generally to be found in all large towns, so that in a European War it would probably be best to use this gas, and tow the balloons inflated to any point required. The lifting power of this gas is about 35 lbs. per 1,000 cubic feet, so that nearly double the amount is required to lift the same weight as a given volume of hydrogen. 2 to 2½ cwt. of coal gives about 1,000 cubic feet of gas. Gas of this kind, or "adulterated hydrogen," may also be made from many organic substances, such as wood, peat, grass, &c. Coal-gas may also be made lighter by various processes.

Ammonia has also been suggested for aëronautic purposes. It has much the same lifting power as coal-gas, but has the additional great advantage of being unflammable, so that a heating apparatus, for causing rise and fall, could easily be applied. It has also the property of being absorbed by water. The great objection to its use, however, is its power of attacking and rotting the material in which it is enclosed. I find that it rots even a pure india-rubber balloon.

It has been proposed to compress gas in steel cases (which might be used as pontoons), but the great strength requisite would make them practically too heavy, and they would have but few advantages over a portable gas-making apparatus.

The original system of Montgolfier, of inflating a balloon by rarefying the air within it by heat, is so simple and rapid that it at once suggests itself as suitable to war balloons. But on the other hand, its lifting power (25 to 30 lbs. per 1,000 feet) is so small, and it is so difficult to retain such a balloon captive, while the danger of catching fire is great, that it has not been found serviceable in actual practice. Godard tried this system at Solferino, but, as we have seen, discarded it in favour of a gas-balloon.

Another plan has been suggested for captive Montgolfiers. The balloon is connected by a long pipe with a powerful furnace on the ground. Thus all the weight of the stove and fuel is done away with, and most of the danger of fire.

(6.) *Material.*

The material of which a balloon is generally made is cotton or silk. Of course the object is to obtain the lightest and closest stuff combined with the greatest strength. This is covered with a varnish, chiefly composed of boiled linseed oil, and often containing india-rubber. It is almost impossible to get a varnish which is really

impervious to gas, that is, which can prevent diffusion, and a great variety have been tried. Balloons have also been made of macintosh, goldbeater-skin, and even of copper. The weight of the material of an ordinary balloon ranges about $\cdot 02$ to $\cdot 05$ lb. per square foot. The seams are generally about $\frac{1}{2}$ inch wide, double sewn, and should always be stronger than the material. Balloons have also been constructed without any sewing, the seams being cemented together, so that much time and trouble is saved.

The original Montgolfier balloons of the last century were made of paper or linen, and a stove containing chopped straw suspended below it. This was of course very dangerous, but might now be greatly improved upon by rendering the material fireproof and using some more convenient form of stove. Although it is easy to make linen incombustible, it is not possible to prevent its being charred or rotted by heat. Asbestos has been suggested as a suitable material, but its great weight and expense would prove a serious drawback, although a recent experiment with a balloon partly made of this substance was said to be successful.

The cordage has sometimes been made of silk, in order to be light and strong; and steel-wire rope has been tried as a guy-rope, but it is very liable to kink, which renders it comparatively useless.

(7.) *Navigable Balloons.*

Finally, there remains the question of the extent to which balloons may be guided. It will be at once understood how very much more useful a balloon would be if it could be steered from one place to another. There are two general principles on which it has been attempted to accomplish this object. The first by utilizing the various currents of the air, and the second, by mechanical propulsion.

There are very frequently overlaying one another currents of air blowing in different directions above the same spot, so that it is only necessary for the balloon to rise to some certain elevation to be driven more or less in the required direction; but at present the only means of altering the altitude of the balloon is by the expenditure of gas or ballast, and as the delicately-balanced machine is easily affected by changes of temperature produced by the sun and clouds, it requires a great expenditure of gas and ballast, the life and blood of the balloon, to keep it long in one level. Numerous inventions have been devised for accomplishing this object, such as vertical screws, gas-compressing pumps, &c., but all have their objections. There is one plan which appears to me worth trying. Very shortly after the invention of balloons Pilâtre de Rozier endeavoured to combine the advantages of fire-balloons and gas-balloons, viz., the easy alteration of specific gravity by the application of heat with the greater ascensional power of gas. But he combined them in a very simple and very ignorant way, which resulted in the gas igniting and the balloon being precipitated to the ground. Cavallo and others suggested a Montgolfier balloon suspended some way below a gas-

balloon, so that the latter would assist to support the weight, and yet be out of reach of fire.

Now it seems to me that a powerful lamp might be applied to a gas-balloon without danger, on the safety-lamp principle, and placed some distance from the gas. It might be connected by a tube which would conduct the hot air to a small balloon in the interior of the large one (*vide* Diagram). Then the lamp could be turned up or down as required, and it will be seen that in a balloon of 25,000 cubic feet, raising the temperature 1° would be equivalent to discharging 4 lbs. of ballast. The apparatus could be applied to any balloon, and need not weigh much. The only question is whether the temperature of the gas could be altered with sufficient rapidity to secure the desired practical effect.

Methods of propelling balloons through the air have been devised in hundreds, and, although I believe we can never hope to steer them against anything like a strong wind, yet occasions may often occur in which such machines would be of great practical use.

So long ago as 1852 the French engineer, M. Giffard, ascended from Paris in an elongated balloon, 150 feet long by 40 feet greatest diameter. In the car he carried a small steam-engine of three horsepower, weighing 3 cwt. This worked a screw, 12 feet diameter, 110 revolutions a minute. A triangular rudder was placed behind. The balloon was filled with coal-gas, and the total weight was 3,100 lbs. The experiment was made on a very windy day, but a deviation from the direction of the wind was made, showing an independent velocity of 5 to 7 miles an hour, and the rudder was found to act well.

In 1872, M. Dupuy de Lôme, naval architect to the French Government, made some experiments under Government orders. The balloon used was somewhat similar to that of M. Giffard, and was driven by a screw 30 feet diameter, worked by four men. The balloon in this case, also travelled about 6 miles an hour through the air.

These two are the only really important experiments that have been made in this line. In the first, the balloon was filled with coal-gas; if hydrogen had been used there would have been an available buoyancy of some 3,000 lbs. more for engine! The second took up a party of fourteen persons; if only one had ascended he could have taken up a steam-engine weighing some 1,700 lbs. Dr. Pole has calculated from these data that it will be possible to construct a balloon which could travel at the rate of 30 miles an hour through the air.

Some experiments, on a small scale, have lately been made, also in Paris, with an electric propeller. M. Tissandier has an elongated balloon, 11 feet long, to which a screw is attached, worked by a small dynamo machine, driven by a couple of Planté accumulators. But the action is very slow.

In conclusion, I would remark that in this paper I have endeavoured briefly to put together what is known of military ballooning, both in regard to actual experience and experiment, and to the theory and scientific principles which may be applicable. There is no doubt that much invaluable assistance can be given to the various arms of the

Service by balloons, but to make the most of this assistance we absolutely need more continuous experiment and study. Then we shall undoubtedly have balloons better fitted for campaigning and more under control, even if the actual navigation of the air be deferred some little time longer, and meanwhile Carlyle's words must remain true—"Beautiful invention; mounting heavenward, so beautifully, so unguidably! emblem of much, and our Age of Hope itself."¹

Major TEMPLER: I am sure we must all thank Lieutenant Baden-Powell for the paper he has read to us. It embraces the history of ballooning from the very first ascent. I do not think I shall be out of place in asking him two or three questions before I state what my own work has been. I should like to ask whether he saw in Paris the Egasse Generator. I do not think the French Government have an Egasse Generator; but I believe the Egasse Generator is capable of generating 20,000 feet of gas, and its weight is $3\frac{1}{2}$ tons. The apparatus the French have in their service weighs 2 tons; it was to carry a load of a ton, and the Egasse Generator is loaded complete at $3\frac{1}{2}$ tons, so that the Egasse is only half a ton more. Then I am not quite certain that Lieutenant Baden-Powell likes the system he proposed for heating the gas by fire in the balloon; because, even if you did attain a result from warming the gas in the balloon, it would be rather against it eventually. It might yield fruit for a few seconds, but my own experience is, the steadier your temperature, the longer the balloon will be likely to float in the air. In military ballooning the weight of the apparatus is the great question that not only occupies our attention but the attention of the French Government at the present moment. Then, as to the weights we want to arrive at. We want a pair-horse wagon to carry an Egasse Generator and its contents—the contents of the one charge of gas, and a balloon, and a rope 5,000 feet in length, at 25 cwt., because we cannot get about with a wagon on service if it has a greater weight than that on it. I think you will see that that will be accomplished. As regards the siege operations that you mention, I do not think there the weights would be so effective. You might have weights there of 6 or 7 tons; I do not think it would be well to limit the weight. I can give you the weights of the French equipments that they have ready now, if it would be of interest. They have their equipment ready to move, and supply equipment ready for their balloon when it is moved at 2 tons 6 cwt. I do not know further particulars about the size of their balloons; I only know that those are the weights. Captain Lee tells me that 17,000 feet is the capacity of their balloons. As you have just told us, the French are very cautious in giving information to any one, and it is rather difficult to get information from them. Allow me again to thank Lieutenant Baden-Powell for bringing the history of balloons up to the present day.

Mr. F. W. BREAREY: May I be allowed to ask a question? I want to find out what has never been understood by the public, and especially by the Society of which I am the Secretary—the Aëronautical Society—how it was that balloons were not sent off in the very first equipment to Egypt. If there is any one who could give us the information it would be very satisfactory.²

Colonel BEAUMONT, late R.E.: I have had some little experience in ballooning, and have been asked to say a few words. I do not know really that there is much to be said, because the paper is very exhaustive. At the same time, like most papers on ballooning (and I say it with due deference to the writer), it rather misses the difficulties of the question. And the answer to the question why balloons have not done more than they have done at the present time is not because we are unable to find means to enable them to move, not because it is impossible to drive

¹ Carlyle, "The French Revolution."

² This is correct, but the Chairman's reply was *not* satisfactory, because there were facilities within effective distance of inflating the balloons with COAL gas and conveying it where required, therefore no weighty apparatus was necessary. There was something more blamable than neglect in this matter.—F. W. B.

a balloon at a reasonable speed through the air, but simply because we have not been able as yet to invent a steam-heat or other engine of sufficient power to enable us to store within a reasonable weight what is requisite to impel the balloon. You may ask why should it be more difficult to apply motive power to a balloon than it is to a railway carriage or to a canal boat? The reason is owing to the different circumstances of the case, and the fact that in the one instance you have a fulcrum upon which you can rely, and in the other case the fulcrum is so far wanting that you lose, say, nineteen-twentieths of your power before you can avail yourself of it. I was talking to M. Dupuy de Lôme, who has accomplished one of the successful attempts made to guide a balloon, and I believe the statement of his results has been correctly put down in the paper under discussion. If his view of the case is right, what is really wanting is some exhaustive experiments, which would necessarily take a long time and be extremely costly, to enable the question to be determined, what would be the greatest amount of energy which you could get out of a given weight. I consider, before even looking at it for practical purposes, you would require an engine that would give ten times the amount of power for a given weight that the very best steam-engine that has ever been constructed up to the present time has done. Whether that is a likely thing to be found is another matter—I cannot tell; but that is the way from which the problem should be attacked. I do not know that there is anything else that strikes me of interest at the minute, except perhaps this: that I have no doubt whatever that there is a future before the balloon for the purpose of observation, and especially in the case of a siege. Take the siege of Paris. It might be quite worth while for the defenders, or indeed the attackers, to run considerable risks in obtaining photographs of the enemy's field of operations. I myself saw when I was in Paris a very good photograph that had been taken from a balloon from a height of about 700 or 800 feet. It was clear and distinct in its details. I believe the difficulty that has been experienced up to the present time in photographing from balloons has been not so much to keep the balloon absolutely steady as to keep it at one altitude; because directly the position of the balloon relatively with the earth is altered the focus of the photograph is changed, and it becomes extremely difficult to join the several sheets together. If some means can be taken to keep the balloon at one height, no doubt a series of photographic plans might be taken which would have an enormous value. Again, with reference to the directing of balloons, and how that would influence the case of offence and defence, it would make very little difference indeed to the defenders of a town, because it does not so very much matter, so long as they get out of the citadel, which way they go; but it would be of extreme importance if there could be found some means of obtaining news or getting people or information into a town. It may not be very much to say that you drive a balloon at the rate of 6 or 7 miles an hour through the air; and consequently if a balloon is passing at 20 miles to alter its direction to the extent of say 1 to 3. But you must remember the alteration of the direction of a balloon to even so slight an extent as that may make the difference between striking or missing the place you intended to alight at; and consequently I quite think, with our present appliances, it would not be a hopeless task to communicate with a besieged town if you were to make a series of balloon ascents to windward of the place that you wished to communicate with; and then, perhaps, one out of every three or four balloons that had been started by using the mechanical means available for changing their direction, and at the same time profiting by any chance currents of air, really to alter the direction in such a sense as to make the balloon useful for war purposes in the case of the defence of a town, in order to communicate with it.

Vice-Admiral HAMILTON, C.B.: I should like to ask one question. We have heard a good deal about a balloon being sent up from one side, but I should like to know if it is ever intended to take into consideration what might be the result if balloons were sent up from both sides and happened to meet in the air? Are we to have battles in the air?

Admiral Sir LEOPOLD M'CINTOCK: By the favour of the Admiralty, I have laid on the table a balloon which we had out in the Arctic Expedition of 1850-51. It is about one-tenth of the volume of the balloons that we generally used to distribute printed messages. It was thought that by means of these balloons numerous

printed papers could be scattered in the Arctic regions, and probably within the reach of some of the people of the missing Franklin Expedition. That the attempt was not successful was not the fault of the balloon, but owing to the fact that the expedition was lost before any of these balloons were sent out from England. I should like to ask the writer of this very interesting paper if he is aware whether anything has been done towards the application of stored-up electric force for the propulsion of balloons?

Lieutenant BADEN-POWELL, in reply, said: I am very much obliged to those gentlemen who have taken part in the discussion, for I am sure they have greatly added to the interest of the paper. I may state, in reply to Major Templer, that it was the Egasse Generator that I was referring to. I have some details as to the weight of engines which Colonel Beaumont referred to. The Thornycroft steam-launch engine, which appears to be one of the lightest, weighs about 600 lbs. for eight horse-power, and consumes 50 lbs. of coal an hour. Professor Ayrton considers that electro-motors are lighter than steam or any other engines, and that one horse-power can be obtained with a weight of 50 lbs., while a French scientist, M. Napoli, has declared that an engine could be made which would only weigh 7 lbs., and would give one horse-power for an hour. With regard to communicating with a besieged town, M. Tissandier made two attempts to get back to Paris from Rouen, but each time the wind was unfavourable. As to whether there would be likely to be aerial battles, I should say the balloons would not be likely to get near one another if held captive; and if they were free, I should very much doubt whether they would ever attempt to approach one another. With regard to the storage of electrical force, the only experiments I have ever heard of in this direction have been those which I have referred to made by M. Tissandier in Paris.

The CHAIRMAN: Ladies and gentlemen, I believe, in order to close the proceedings, I have to discharge the other portion of my task, and to say a few words on what has passed. When Lieutenant Baden-Powell did me the honour to ask me to take the chair, he did so from some knowledge of this particular subject which he fancied I possessed. I mention this lest, in what I am about to say, special weight should attach to my position here, rather than to such knowledge as I do possess. I may first remark that it is a most difficult subject to deal with, because the votaries of aërostation are amongst the most enthusiastic of mortals, and it is hard to bring them back from the realms of mid-air to the regions of sober common sense. The lecturer said that balloons had been pretty much in the state they are now in for the last 100 years. I say it is very much longer than that, for many hundred of years have rolled away without much advance since the first aëronaut failed, and failing gave his name to the Icarian Sea; but, in spite of that, there is a future for balloons, and our object is rather to consider how far and in what way they may be made applicable for military purposes. I think, as Colonel Beaumont remarked, that in the case of rapid operations they are not in the least useful. You must not take what was done at the Brighton review as a criterion; for in that instance they had everything in their favour, inasmuch as there were none of the impediments of war, and the balloon operators could do as they liked. They had very able Officers in command—Major Templer, Captain Lee, and Captain Elsdale; and, therefore, they did accomplish a considerable measure of success. But still I think there can be no doubt that their rôle is confined either to siege operations or to operations of war when very large armies are in the presence of one another, such as the armies referred to by the writer in the early period of the French Revolution. When very large bodies are concerned, and it takes time to move them into position, and when if they get into a certain position they may deliver an attack decisively, then it is of great moment to ascertain what is being done upon the opposite side, and then a good deal may be sacrificed in order to bring up balloons, because, after all said and done, the weight you have to carry, either in the apparatus or in generating gas, or in the adjuncts of the balloons, is very great. It is easy enough to say from two to three tons in France, or three to four tons in Germany, but we, for our part working during many years, could never get it down to that, and I think we may double the least of those weights. When you introduce such additional weights into the ordinary operations of a small army it becomes a very serious thing; and I may take the opportunity,

perhaps, here to answer the Secretary of the Aëronautical Society by saying that we never could have made any use of the balloons in Egypt. Firstly, we did not want them: we knew what we had to do without them; and secondly, if we had had them we never could have got them up to the front. Our weight for a balloon equipment was somewhere about 6 tons, and as we had the greatest difficulty in moving ordinary carts with loads of 3 cwt. over the sands, it is certain enough that balloons could not have been taken forward in time to have been of use, and this I can say of my own knowledge, because the question did come before me in some shape. I feel certain that balloons can be usefully employed only where it is a great object to ascertain what your enemies are doing, and when you have unlimited means of carrying weight. I regret that our Government, having achieved a certain measure of success in their operations, which extended over several years, have not gone on. I think fair success was attained, especially in holding a course by making use of different currents of air at varying heights, and as a certain number of men had been trained, it was quite worth while, in my humble opinion, to thrash the thing out; perhaps it will be taken up again some day. With what has been said respecting the employment of balloons in the siege of Paris, I may remark that the balloon is a very bad carrying machine. The balloons employed with lifting power of over 60 tons only carried 6 tons, I think as far as I recollect the figures. When the day comes that the machine which Colonel Beaumont mentions (and he is some authority on machines as well as on balloons)—when the day arrives that a machine so light, so portable, and yet with such motive power may be devised, then there may be a wider field for balloons, but until that does arrive I think their rôle is limited. In the siege of Paris, although the besieged sent many balloons out, none of them came back, and this fact tells very much against their general employment. I do not say this in any adverse way; I am not I hope summing up the matter adversely; but it is right in considering this matter that the whole of the conditions should be taken into consideration, and that the votaries of balloons should not be suffered to commence, as Colonel Beaumont suggested, by organizing preliminary conditions. I have nothing further to say, except to thank Lieutenant Baden-Powell for his lecture, and to thank you for having so kindly received it.

Friday, June 22, 1883.

T. CRAWFORD, Esq., M.D., Director-General, Army Medical Department, in the Chair.

ON MILITARY HYGIENE.

By F. S. B. FRANÇOIS DE CHAUMONT, M.D., F.R.S., Professor of Military Hygiene, Army Medical School, Netley.

It is now thirteen years since I had the honour of addressing this Institution on the subject of military hygiene, taking for subject-matter the questions: 1st. The Ventilation of Barracks and Hospitals; and 2nd. The Ration of the Soldier. At that time only thirteen years had elapsed from the time of the sitting of the Royal Commission at the close of the Crimean War, an event which proved to be the turning point in the health history of armies. We were then (June, 1870) on the eve of the severest European struggle since the Napoleonic wars of the beginning of the century,—little as the fact was suspected by many who ought to have known better,—and since that time there has been a succession of wars of greater or less importance politically, but fraught with much instruction from a hygienic point of view. Those in which our troops have been directly engaged have been the Ashanti War of 1873, the wars in South Africa, in Zululand and the Transvaal, in 1877–80, the Affghan Campaigns of 1878–79, and the Egyptian Campaign of 1882. With a certain amount of similarity in the circumstances, there were important individual differences which gave a peculiar character to each of these struggles. The first, the Ashanti War, was carried on in one of the most unhealthy even of tropical regions, and the losses by disease were in consequence greatly in excess of the losses by the hand of the enemy, in spite of the rapidity with which the campaign was accomplished. The South African wars on the other hand were carried on in a sub-tropical climate, where the normal conditions are healthy, but where the exigencies of war gave rise to considerable sickness. The Affghan wars were accomplished in a hill climate in the neighbourhood of the tropics, but under circumstances of peculiarity and difficulty, aggravated by the invasion of tropical disease. The Egyptian Campaign was in a country not exactly tropical, but in close proximity to the hottest region of the earth; a country, too, of which our troops had a grave experience in former times as regards health, and of which they retained down to recent times an unhappy reminiscence in the shape of ophthalmia.

In the Army generally very considerable changes have taken place. It has, in the first place, become emphatically a *young* army, and it is gradually assuming a character wholly different from that in which those began their military career who, like myself, have reached the half-century of life. In the second place the foreign service of the soldier is now almost entirely tropical or sub-tropical, the Colonies situated in the temperate zones providing mainly for their own defence. A third circumstance, which has an important bearing upon the health of the troops, is the change in the organization of the Medical Department, the abolition of the regimental system, and the substitution of the unification system in its stead. I propose in the first place to consider briefly the general improvement which may be traced in the condition of the soldier, as shown by the statistics of sickness, death, and invaliding in the general Returns at home and abroad; and afterwards to review shortly the results in the different campaigns above referred to. It is probably in the recollection of those who have given attention to the subject that the sickness and death-rate of our troops at every station was in former times most excessive, at all times exceeding those of civilians of the same ages, even where the actual circumstances seemed in favour of the soldier. If we cast a glance at the older Returns we shall find a condition of things that must excite surprise in any one becoming acquainted with them for the first time, and the simplicity of the means by which the improvement of the present day has been effected would astonish not less, did we not know how the plainest objects are often unnoted from their being actually too near for our vision, just as the most difficult names to find on a map are not those which are in the smallest letters, but those whose letters are exceptionally large and spread over a wide area. In the able abstract by Surgeon-General Balfour, F.R.S., which is to be found in the second volume of the Army Medical Department Reports, that for 1860, we have the following data:—

	Admissions per 1,000.	Deaths per 1,000.
Guards (before 1837)	(no record) ..	21·6
„ (after 1837)	862	20·4
Infantry of the line (after 1837)....	1,044	17·9

In 1860 the following were the ratios:—

	Admissions per 1,000.	Deaths per 1,000.
Guards	737	9·48
Infantry	904	9·95

In 1870 the following were the ratios:—

	Admissions per 1,000.	Deaths per 1,000.
Guards	627	9·16
Infantry	707	7·89

In 1880 the ratios were :—

	Admissions per 1,000.	Deaths per 1,000.
Guards	1,004	7·50
Infantry	944	5·79

The total ratio for the Army at home for the ten years 1870-79 was :—

Admissions	809	Deaths	8·18
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And for 1880 :—

Admissions	896	Deaths	6·83
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There has been thus a steadily diminishing rate of deaths, that is of serious disease. The rate of diminution has been :—

Rate of 1860 was 44 per cent. less than that before 1854.

„ 1870 „ 26	„ „ of 1860.
„ 1880 „ 36	„ „ of 1870.

The general death-rate of the Army at home for the ten years 1870-79 was 56 per cent. below that before 1854, and the rate for 1880 was 62 per cent. below it.

If we now look at the classes of disease which have been thus diminished, we shall find that they are especially those which have been distinctly recognized as preventible by sanitarians, viz., destructive diseases of the lungs and typhoid (or enteric) fever. With regard to the former, we find that the ratio of death from destructive lung disease (included under the head of phthisis or consumption) was, in the period 1830-36, 7·83 per 1,000, and in 1837-46, 7·89, or practically the same, showing no tendency to diminish; and those numbers did not include the deaths from inflammatory disease of the lungs. Thus in the years 1830-36 there were annually in the Foot Guards 10·8 deaths per 1,000 from phthisis, but 3·3 also from other lung diseases, making a total of 14·1. Now the total deaths from *all* diseases in 1880 were only 6·83 per 1,000, or 12 per cent. less than the consumption deaths alone thirty years ago, and 37 per cent. less than the consumption rate of the Foot Guards. The total consumption death-rate of the Army in 1880 was under 2 per 1,000, or 75 per cent. less than the pre-Crimean rate. This eminent improvement has been conclusively proved to be the result of the improved condition of ventilation in the soldiers' sleeping rooms, which has been gradually effected since 1858. But that it is not yet sufficient we know from two sources. In the first place, the amount of air contemplated by the Barrack Commissioners is much smaller than what is now recognized as necessary for the best health and efficiency. But the Commissioners showed wisdom in restricting themselves to requirements which there was a reasonable hope of carrying out, rather than in insisting upon conditions which would certainly at the time have been looked upon as chimerical. The amount contemplated and now given is 1,200 cubic feet per head per hour; but the amount desired in the present

day is just three times that, 3,600 cubic feet, or one cubic foot per second. In the second place, if we compare the phthisis death-rate of the Army with that of civil life, we find it to be still in excess. For that purpose we must take not only the death-rate, but also the ratio of invaliding, for by this the Army gets rid of cases which would otherwise prove fatal, but which go in reality to swell the death-rate among civilians. Of course the effect upon the civil death-rate is hardly appreciable, but the difference that their removal makes on the Army rates is very considerable. Thus in 1880, 4.15 per 1,000 were invalided for this class of disease, and this added to 1.98 of deaths gives a total rate of 6.13 per 1,000 lost to the Army from one class of disease. If now we compare these figures with the civil Returns, we find that the total deaths on the general male population is only *two-thirds* of this, that London shows only 75 per cent. of it, and that the worst districts of England (excluding hospitals) show only 81 per cent. of it, or less than *five-sixths* of the Army rate. The healthiest districts of England, on the other hand, show only 1.96 per 1,000, or 68 per cent. less than the Army rate. Now, when we consider that the Army is a group of selected lives, and that the consumptive recruits who are rejected fall back into the ranks of civil life, it is clear that there is still something that keeps up this serious drain upon the Service. This something, I have no hesitation in saying, is the still imperfectly ventilated barrack room. It is just a quarter of a century since the great change was begun which has been so happily fruitful in saving to the State and health to the soldier; but much still remains to be done. I think it is now time to revise again the soldier's accommodation and to improve it so far as to bring his condition somewhat more abreast of modern sanitary science. The thing of course could be easily done, for it is merely a question of money, but I am afraid the getting of the money will prove the difficulty. The improvement of barrack rooms is less striking than a battle or a brilliant campaign, but its good effects would be more certain and lasting, and the cost not greater. Could we double the space the soldier has in barracks, even without increasing the means of ventilation, an enormous benefit would be obtained, but if we could do both, as we should certainly do if the opportunity were given, there is no reason why the loss from phthisis should be more than in the healthiest district in England. This would be a saving of about 350 men per annum in the home Army alone, and if we take the usual estimate of the value of a soldier at 100*l.* this would be a saving per annum of 35,000*l.* This capitalized at only twenty years' purchase would be 700,000*l.*, which would go a long way in providing the additional accommodation desired. But we should be doing more than this, for we should be thus increasing the number of healthy males destined to be fathers of healthy progeny, and the Army would thus do its part in gradually stamping out consumption in our midst.

Another important group of diseases is the so-called zymotic or febrile group. Among these we find, as the most important in this country, typhus fever, typhoid (or enteric) fever, and small-pox, with

cholera which is only an occasional invader. Of these we may say that typhus has ceased in times of peace to be a matter of anxiety. Two conditions must be present together to give rise to or favour the propagation of this disease, viz., crowding and destitution. Neither of these is now likely to be present among our soldiers, therefore the origination of typhus among them is rendered practically impossible. But the disease once begun is exceedingly contagious, and can be easily communicated from person to person, so that in a serious epidemic no class is free from the danger. The general improvement, however, in the well-being of the poorer classes has to a large extent abolished the causes of typhus in late years, and the health of the soldier has reaped the benefit. In time of war it is a disease to be always feared. It caused immense loss to our troops in the close of the last and the beginning of the present century; it severely scourged the French Army during the retreat from Leipzig; it was one of our direst foes in the Crimea, and it committed great ravages on both sides during the last Russo-Turkish War. It has sometimes been remarked as a curious fact that there was no typhus to speak of during the siege of Metz, but it need not be wondered at, for the compression was not nearly so great as has been the case in other instances, and there was no true destitution; facts in their result which ought to be taken into consideration in estimating the wisdom or good faith shown in the surrender of that important position, a surrender which hopelessly compromised the fortunes of the French in that terrible conflict.

As regards small-pox, the disease has been practically stamped out in the Army at home. During 1880 there were only three cases of the disease in 84,000 men, and the ratio for years back has been exceedingly small, although from the inconvenient form of the Returns it is difficult to state the exact number of cases, mixed up as they are with other eruptive disorders. We may, however, confidently say that the vaccination and re-vaccination of the troops has been so perfectly performed as to reduce the chance of their taking small-pox to a minimum. Among our foreign stations we had similarly small numbers in 1880, the only cases occurring being in Gibraltar, Malta, China, and India, 11 in all and 2 deaths; or a total ratio at home and abroad of less than 9 cases per 100,000, and little over 1 death per 100,000 of strength.

Cholera.—This formidable disease is endemic only in the Delta of the Ganges and Brahmaputra, and perhaps also in that of the Irrawaddy. Its causes are still obscure, as are also to some extent the modes of its spread. We know, however, that it does spread from time to time beyond its usual focus, and that no country is safe from its invasion. We have good proof that hygienic measures, such as the provision of pure water in plenty, care about the removal of excreta and general cleanliness, are powerful means of combating this dreadful enemy. What can be done, when those hygienic means are carried out uniformly and well in a community, may be seen by the diminution of cholera deaths in the Army at home in the last epidemic—that of 1866. In former epidemics the troops had suffered severely

like the rest of the community, but in 1866 there were only 13 deaths out of 70,000 men, and only 17 cases of the disease, which is a very fatal one; the usual mortality being about 2 out of 3 (or 20 out of 30); but in the above group it was even more, 2·3 out of 3 (or 23 out of 30). The above death-rate was little over one-third of the general cholera death-rate of the kingdom in that year. Since that time so much has been done, both in civil and military communities, to improve the sewerage and water supply, that I think it is not too much to say, that even if cholera did reach our shores, it would in all probability fail to establish a foothold.

The remaining group of fevers, namely, enteric (or typhoid) fever, is of much more importance to us than any of the former. Cholera is a mere casual visitor, but typhoid is always with us: typhus arises under conditions that are quickly recognized, and may be rapidly altered, but typhoid is a disease of insidious character, the cause of which often lurks unsuspected; against small-pox we have a safe defence and sure prevention, but we have none such against typhoid. This disease kills in the United Kingdom some 10,000 to 11,000 every year, the total number being about 108,000 for the first ten years (1869-78) after the disease was separated from other fevers in the Registrar-General's Returns. It is a disease which is peculiarly a disease of bad sanitation, arising from either air or water being poisoned by the emanations from excreta, undergoing decomposition in confined spaces. It has often shown itself more a disease of the rich than of the poor, and this for two reasons, it is believed. Firstly, because water-closets and such conveniences have been more generally *within* the houses of the better classes, whilst the poorer more generally resorted to places outside. Sewer air therefore would be less likely in the latter case to get in from ill-ventilated and untrapped drains. Sinks also, and fixed baths are other channels of access for sewer air. The second reason has been thought to be (although this is less certain) the mode of living of the wealthier classes, especially the use of richer and more plentiful food. There is, however, no reason for any one taking typhoid fever, if proper precautions be adopted; drain and soil pipes may be properly trapped and ventilated, sinks and bath-wastes may deliver harmlessly in the open air; and the water supply may be effectually protected from all contamination. In former days we lost a number of men from fever, but this has been gradually diminished. In ten years, 1837-46, there were 620 admissions, and 17 deaths per 10,000 of strength, for continued fever; in the eight years ending 1867, there were only 220 admissions, and 5 deaths per 10,000; in 1871 the ratios were only 9·2 and 2·5 respectively. In the four years ending 1875, the deaths were 3·7 per 10,000; in the five years ending 1880, the deaths were 3 per 10,000, and in 1880, 2·6. If we compare this with the condition of things in civil life, we find that the death-rate, among male adults of the same ages as soldiers, is 10 per 10,000, or nearly four times the Army death-rate. If we look again at the proportion that the typhoid deaths bear to the total deaths, we find that in the Army they are only 4 per cent. of all deaths, whilst in civil life, at the same ages, they are

9·6 per cent., or nearly two and a-half times as great. This result, following as it does on the marked improvements which have been carried out in the sewerage and water-supply of barracks at home, is a strong corroboration of the view which connects typhoid fever with imperfect sewerage arrangements and contaminated water.

Of the other diseases which cause mortality among troops at home, there is one group that attracts attention, and that is, the diseases of the heart and great vessels. This question has been carefully investigated by various medical officers, but particularly by Inspector-General Lawson (retired), by Professor Maclean, of the Army Medical School, by Surgeon-Major Myers, of the Scots Guards, and by the late Professor Parkes. It is certainly a startling thing to find even now that this class of diseases stands second in the list of mortality among soldiers, and causes more than one-seventh of all deaths. Dr. Lawson calculated some years ago that aortic aneurism (a sack-like dilatation to the great artery of the body) was *eleven* times more frequent among soldiers than among civilians. Mr. Myers showed that the deaths and invaliding from heart disease in the Foot Guards as compared with those in the Metropolitan Police were as follows:—

		Died per 1,000.		Invalided per 1,000.
Foot Guards	....	0·80	....	3·20
Police	....	0·29	....	1·37

They were also greater in the Army than in the Navy to the extent of 35 per cent. of deaths and 50 per cent. of invaliding. Compared with the general population (males between 15 and 44 years of age), Dr. Lawson showed that the deaths from heart disease were 60 per cent. more numerous in the Army than in civil life. In 1880 there died of diseases of the heart and vessels in the Army at home 81 soldiers, there were invalided and discharged from the Service 390, and there were constantly sick 115, so that there were 586 men whose service was lost to the State, or about two-thirds of a battalion. It has further been shown that although the loss is large in all arms it varies with the particular arm. Thus, in the infantry of the line the total loss by deaths is 1·11 per 1,000 (1867–71, for since that time details are wanting); in the Foot Guards, 1·36; in the cavalry, 1·44; and in the artillery, 2·25 per 1,000. Or, taking the infantry of the line as unity, we have 25 per cent. more in the Foot Guards, 30 per cent. more in the cavalry, and 105 per cent. more in the artillery. Considering that the ratio in the infantry is more than double that of civil life, there must be some sufficient cause for this remarkable amount of disease. In civil life rheumatic fever and disease of the kidneys are the two most common causes of heart disease, but neither of these can operate much in the Army. Besides, Dr. Parkes showed that, of the young soldiers invalided in the two first years of service, diseases of the circulation formed 14·23 per cent. of all causes of invaliding. Neither syphilis, nor intemperance, nor excessive smoking, although these might be contributory causes, could account sufficiently for the condition of things observed. After an inquiry of an exhaustive

character it was narrowed down to one set of causes, viz., the work the soldier had to do, and the unfavourable circumstances in which he had to do it. All who are conversant with the subject will admit that the life of the soldier in time of peace is by no means a hard one, that is, he works on the average less than the ordinary labourer or artizan of the classes from which he is taken. Thus, if we take the average daily work of a labourer at a little over 300 foot-tons, the soldier does not do more than about two-thirds to three-fourths of this; or, say, a labourer or artizan may do 2,000 foot-tons a week, whilst a soldier probably does 1,400 to 1,500. Indeed his rations, if he depended entirely on them, would not provide sufficient energy for more than this. But in the work of the soldier we have an element which does not always enter into the work of the artizan or labourer, and that is, the increased velocity of work producing *strain*. The effects of strain in mechanics is well known to all engineers, and the human frame suffers much in the same way as beams, girders, and mechanical engines do. Men who suffer most in this are the artillery, whose drill with their special arm calls for very sudden and violent exertion; next come the cavalry, who are also called upon for sudden exertion, although in a less degree; and, lastly, the infantry, who have to undergo rapid work, such as in doubling, which tells upon the men. Now this is exactly the order in which the mortality from heart and vessel diseases shows itself—the artillery being highest and the infantry lowest. As those exertions, however, are part of the work of the soldier they cannot be altogether avoided, but the conditions under which they are done may certainly be improved, and the necessary evils lessened. Now, formerly the soldier performed his work under very adverse circumstances, particularly in the matter of his accoutrements and his clothing. The effects of the old knapsack and cross-belts are too well known to require repetition here, and much, if not quite all, of the objections have been removed by the introduction of the new equipments. But it is not the same with the clothing, which is still too tight across the chest, at the neck, and round the armpits, tending not only to impede movements, but to distress the man. No civilian would consent to work under the conditions imposed upon the soldier, whilst the sailor of the Royal Navy, who is exposed to at least as hard and sudden work, suffers in a much less degree than his Army brother. Looking to the statistics of successive periods we find that in 1867–71 (5 years) the deaths from diseases of the circulation were in the Army 1·462 per 1,000, and that they formed 16·71 per cent. of all deaths; in 9 years, 1872–80, the deaths were 1·17 per 1,000, and 14·8 per cent. of all deaths; and in the last three years of this period, 1878–80, the deaths were 0·65 per 1,000, and 10·4 per cent. of all deaths. In 1880 the deaths were 0·52 per 1,000, and 9·1 of all deaths. We have here a progressive improvement, no doubt due in large measure to the better arrangements for the carriage of the necessaries. But when we consider that the loss in the Army is still above that in civil life, and that the soldier's life is a selected one, no recruit being taken who shows signs of disease in the heart and vessels, it is obvious that much yet remains

to be done. The percentage of all deaths in civil life, which the circulation deaths show at all ages, is $6\frac{1}{4}$, between the ages of 15 and 35 it is $6\frac{1}{2}$, between 15 and 45, $8\frac{1}{2}$, whilst between 15 and 25, the ages to which our Army has been tending, it is under $5\frac{1}{2}$. Now, as we have already seen the percentage in the Army for three years, 1878-80, was 10·4, and in 1880 alone still 9·1. Again, those diseases are in the Army second in the scale of mortality, whereas they are only sixth in the list of causes of total deaths in civil life at corresponding ages. Although several causes may combine to produce this grave difference, I am convinced that it is the tightness of the clothing which is still hampering the soldier, especially in his more rapid movements. It is much to be desired that the idea of smartness, which is still associated with a degree of tightness and stiffness of dress, should be got rid of, and that our men should be clothed more in accordance with the work they have to do. There is no reason why the clothing should not be made becoming, and we may instance the Navy; no dress gives a more manly and even graceful appearance than that of a sailor, who is equipped for work primarily; besides, the eye would soon accustom itself to a change really useful, and in the words of Vaidy, "*La tenue dans laquelle le militaire est prêt à marcher à l'ennemi est toujours belle.*"

Let me now call attention to some of the changes which have taken place in the statistics of the Army in foreign stations, in some of which changes even more startling than those at home have shown themselves. It is of course impossible to do more than glance briefly at a few, and I may select as typical examples the Mediterranean stations, the West Indies, and our Eastern Empire. The redistribution of our Army has greatly diminished the garrisons in many places abroad, but we still retain a considerable number at Malta and Gibraltar, and a large force in India.

Malta and Gibraltar, from their situations and equable climates, ought to be healthy, and in former times they were really healthier than home stations were. Thus in 1837-56 the death-rate at Gibraltar was only 12·9 per 1,000, or one-third less than that of the Army at home; before 1837 it was not very different from that of the Foot Guards in London. Malta was less healthy than Gibraltar in the second period, but not more unhealthy than the average of home stations, and less unhealthy than London, as represented by the Guards. In 1860 the deaths at Gibraltar were 12·4 per 1,000, but at that time none of the subsequent improvements had been carried out. In 1861-70, however, the ratio was only 8·54, and the average of the ten years 1870-79 was 6·98. The ratio for 1880 was only 4·24, of which 3·57 only were from disease. In like manner in Malta the deaths have been reduced to one-half of the former rates, but they are still too high, as they are 20 per cent. higher than at home for the ten years 1870-79, and 50 per cent. higher than that for 1880. They also exceed those of Gibraltar by 40 and 135 per cent. respectively. What are the diseases that cause this difference? Chiefly continued—that is, enteric (or typhoid) fever. In other words, the drainage of both places is at fault, but more especially that of Malta. But the

sickness at Malta is also too great, being 7 or 8 per cent. above that at home and 20 per cent. above that at Gibraltar. Were it not that a Contagious Diseases Act is in force at Malta, and only imperfectly carried out at Gibraltar, the difference would be more marked still. But it is in the class of fevers that the difference shows itself, the admissions at Malta being 50 per cent. greater than at Gibraltar, and the constantly sick 15 per cent. more. This is due to the existence of a peculiar form of disease, known variously as Malta fever, rock fever, Mediterranean fever, &c., which prevails throughout the Mediterranean shores. It is a painful and protracted disease, as I can vouch for from personal experience, but not a fatal one. It prevails much more at Malta than at Gibraltar, and the cause appears to be defective sewerage. It seems to be a blood poisoning, arising from the soil being more or less saturated with fæcal matter, probably resulting from the practice of cutting drain-channels through the porous rock, instead of laying down impervious pipes. Now the rock at Malta is exceedingly absorbent, whereas that at Gibraltar, being of mountain limestone, is much less so, hence possibly one cause of difference. This defect also tends to the production of ophthalmia; diseases of the eyes are twice as prevalent at Malta as at Gibraltar. All this points to the necessity of remodelling the drainage of Valetta and the adjoining towns and forts.

Turning to the West Indies we find now but small garrisons in the present day compared with those which formerly occupied them; but, such as they are, they present a marvellously improved condition of health upon their state in former times. In 1817-36 the death-rate of white troops in the Windward or Leeward command was 81·5 per 1,000, and in Jamaica 128. In 1837-55 it was 62·5 and 60·8 respectively. In the ten years 1870-79 it was 10·99, and in 1880 only 8·68, or *one-tenth* of the former rate in the Windward and Leeward command, and only *one-fifteenth* of the rate in Jamaica. What were the causes of the former inordinate death-rate and of the great change since? Simply bad hygienic conditions in the one case and their removal in the other, as in all similar cases. In old days the food was bad, the meat nearly always salt, and the use of vegetables was discouraged; the water was generally bad, but rum was only too plentiful. The barracks were totally unventilated, the men slept in hammocks touching each other, there being only 23 inches of width per man allowed, while each had only $22\frac{1}{2}$ square feet of floor-space and 250 cubic feet of total space. And this is the description of the *best* barrack (that at Tobago) in that part of the tropics! No wonder men died at the rate of 16 per cent. in ordinary years and at 25 per cent. in epidemic times. Now all has been changed—food, water, barracks, all have been improved, and we see the result. But there is too much fever and some other diseases, which plainly show that there is still room for improvement.

But our most important possession is the great Empire of India, which absorbs one-third of our regular forces even in times of peace. Here we find changes not less remarkable, and of course on a much greater scale. The evidence collected by the Royal Commission

nearly a quarter of a century ago is a mine of information on this important subject. In the first half of this century, in fact down to the Mutiny, the general death-rate of European troops in that country was about 69 per 1,000. In 1812-16 it was 96·5 per 1,000 in Bengal, and in 1819-20, 80 in Bombay. The same causes were found operating, not only dietetic errors and intemperance, not merely heat and malaria, but bad barrack accommodation, a want of proper ventilation, impure water, imperfect removal of excreta, &c. Once these were recognized, steps were taken for their removal, with the usual result—an immediate amelioration of conditions. In 1860-69 the mortality in Bengal was only 31·27, and in 1870-79 only 20·17. In Madras it was 22·5 in 1860-69, and under 19 in the succeeding decade, and in Bombay it went down to 16·37, or considerably under the home rate before the Crimean War. In 1880 the Madras rate was only 10·51, just one-half of the former rate of the Guards in London. This shows to what a low rate the mortality may be brought, and indeed there is no valid reason why this should not be the normal instead of an exceptional rate. As it is, at present we have great fluctuations; thus in Bengal the average of the ten years was little over 20, but the rate for 1879 was 32, whilst that for 1877 was only 12·5, or a difference (taking the latter as unity) of more than 150 per cent. The other Presidencies are not liable to quite such marked fluctuation, but still they are considerable. The causes in Bengal are several, but one of the chief is cholera, which finds its home in the eastern division of it. It is always present there more or less, but every now and then it becomes exacerbated, bursts its usual bounds and spreads into the remoter parts of the province. If we remove the cholera deaths we find that the death-rate is much more uniform and more like that of the rest of India. At the same time the general death-rate is too high, and there is no doubt it can be reduced. There is too much continued fever, that is typhoid, and this is distinctly preventible; there is also too much paroxysmal fever, avoidable by better selection of stations; too much phthisis, avoidable by better barrack accommodation and improved ventilation. The sickness is too large, as well as the death-rate, being twice the rates at home. There is one point that may well be insisted upon, and that is the imprudence of the regulations which confined men to barracks during the most of the day. The motive was good, viz., to keep them out of the sun, but the remedy was worse than the disease, for it compelled them to breathe a foul and tainted atmosphere, which they had again to breathe at night; and it made their lives irksome and monotonous to a degree that was intolerable. Men may be trusted to keep out of the sun without being subjected to such a terrible and destructive ordeal. A proof of what has been said may be found in the fact that those who are least confined to the house in India enjoy the best health. Officers are not so restrained, and their health is better than that of the men; civil servants have to do much of their work in the open air in very hot weather, and they are more healthy still; and planters, who are necessarily active during the day, are the healthiest of all. The Medical Officers on the Madras establishment (as shown by the statistics of the Medical Fund) die at

a less rate than those of the British Army, taking all stations together, temperate as well as tropical. In the words of Miss Nightingale, men may live and not die in India; but the condition is that they shall live hygienically, and surely it is the business of the Government that, in the case of troops, who are not free to choose their way of life, no obstacle shall be placed to prevent the best and most hygienic form of life. I feel convinced that, if the rules of hygiene were properly carried out, the death-rate in India need differ very little from what it is at home, although men will always be handicapped to some extent by excessive heat and malarious influences. But active lives will combat the former, and improved drainage and means of agriculture the latter, whilst we may hope that it is not chimerical to believe that a time will come when cholera will be merely an historical curiosity. In the meantime it is possible even now to protect the young soldier from typhoid fever, cholera, and dysentery, in which case he is actually better off as regards health when in India than he is in barracks at home.

We may now turn shortly to the question of hygiene in time of war. If hygiene is important in time of peace, it is infinitely more so in time of war. There is nothing which so impairs and ultimately paralyzes a force as disease; no loss that the enemy can inflict in battle being at all comparable to it. This has been recognized by all great commanders. It was preventible disease that caused the collapse at Walcheren, that more than once threatened the armies in the Peninsula, and that produced our disasters in the Crimea. In the Walcheren Campaign there was hardly any fighting; but the position was so badly chosen, without any reference whatsoever to medical opinion, that the fate of the expedition was sealed almost before a shot was fired. In three months 2,000 men perished and 10,000 were attacked with disease, which the majority never afterwards got rid of. One-fourth of the entire force perished (8,000 deaths), and the greater part of the remainder filled the hospitals for many a long day.

The history of the Crimean Campaign is well known. By a combination of circumstances, not unlike that of Walcheren, the first army perished, some 16,000 men dying of disease alone, the most of them during the first winter of the campaign. Unlike the Walcheren story, however, the war lasted long enough to enable a recovery to be made, and we had in the second year a condition of health greatly superior to that of the troops at home, and in the spring of 1856 there was hardly a man who could not have marched against the enemy, the number of sick being in many cases under 1 per cent., and these trifling cases, whilst in some battalions there were practically no sick at all.

The diseases which were most fatal at Walcheren were paroxysmal fevers, typhus (and probably typhoid), and dysentery, aggravated by scurvy. These were the result of malarious site, bad water, bad rations, crowding, and inaction. In the Crimea the diseases were typhus and typhoid fevers, diarrhoea, dysentery, aggravated by scurvy, and at certain times cholera. These were due to the same

causes, except the malarious site, which, however, operated on the army in Bulgaria. My colleague, Professor Aitken, has also drawn attention to the marked influence which previous exposure of troops has in diminishing their power of resistance. In the Walcheren Campaign a large number of men had already gone through exhausting service in the preceding years, and in the Crimean War those men who formed part of the Bulgarian Army suffered to a greater extent than the men who went to the Crimea direct.

Putting on one side the Indian Mutiny, in which the circumstances were peculiar, the next war in which our troops were engaged was that in the north of China in 1860. This was of course a small affair so far as the number of troops was concerned. The total sickness and mortality were at the rates of 2,049 admissions per 1,000, and 53·98 deaths, including both North and South China. In the North China force alone the rates were, from May to July, 1620·7 admissions and 22·55 deaths, and from August to November 15, 1823·8 admissions and 65·54 deaths per 1,000 of strength. Fevers, dysentery, diarrhoea, and cholera constituted two-thirds of the deaths, but if they be compared with the preceding years of Chinese experience it will be found that they differed but little, except for the better, from the previous ratios; for in 1859 the admissions were 2,783·2 per 1,000, and the deaths 59·35, a marked proof of the excellent way in which the hygiene of the Army was attended to.

Our next small war was that of Abyssinia 1867-68. The ratio of admissions was only 891·6, and of deaths 36·14 per 1,000 of strength. There was nobody killed in action, but 9·37 died from accidents, so that the actual deaths from sickness were only 26·77, of which 47 per cent. died from dysentery and diarrhoea, less than 10 per cent. from fever, there being but one death from continued, that is (probably) typhoid fever. This is an excellent example of good hygiene in the field.

In the Ashanti Campaign of 1873 the amount of sickness was small if we consider the nature of the country in which the war was waged. This was due to the facts that a suitable season was selected, that the war was carried out with great skill and rapidity, and that the arrangements for the hygiene of the troops were admirably planned and well carried out. As it was, the sickness amounted to about 1,700 admissions, and the deaths to 31 per 1,000 of strength (per annum). The Officers in this campaign actually suffered more than the men. The chief diseases were fevers, chiefly remittent, sunstroke, and heat apoplexy, and dysentery and diarrhoea; but the comparatively small mortality, in an expedition campaigning in one of the most pestilential countries in the world, is a very remarkable circumstance. Now, in all these three campaigns—in China, Abyssinia, and Ashanti—the influence and advice of the Medical Department were allowed very great weight, and as in each case the principal medical Officer of the expedition was a man of great ability and long experience, the Army profited accordingly.

I now come to the most recent operations. Although the campaigns in Afghanistan and South Africa are both interesting and full of

instruction, I should not have time to dwell upon them within the limits of the present lecture. I shall, therefore, refer briefly to the late war in Egypt only. The events of it are fresh in the memory of all, the genius with which it was planned and the consummate skill with which it was carried out. It was waged in the hot season of a sub-tropical region, under circumstances which placed great strain upon every part of the force. Yet the hygienic results are extremely good. Out of a force of 13,013 average strength there were 7,590 admissions to hospital in a period of 87 days, of which 671 were from wounds and injuries, leaving a ratio of admissions for disease of 530·2 per 1,000. If this be expanded into a ratio per annum it becomes 2,222. Of these about 10 per cent. were constitutional and venereal disease, not peculiar to campaigns, so that the total amount may be reckoned at 2,000 per 1,000 per annum; of these only 17 per cent. were febrile diseases, whilst 38 per cent. were diseases of the digestive system, chiefly dysentery and diarrhœa, and nearly 17 per cent. ophthalmia, which is always so common in Egypt. As for the deaths, there were 172 deaths in the whole force, of which 98 were from battle or accident, leaving only 74 from disease, or a ratio of 5·88 per 1,000 for 87 days, equal to 24·67 expanded to a year, a rate not much greater than what the Guards showed in London before the Crimean War. It was even 6 per cent. less than the exceptionally healthy Abyssinian Campaign which had previously stood out as a hygienic model. If to this it be added that, in a country with such an evil reputation for the disease, not one man out of 1,145 cases of ophthalmia lost his sight, and that there was, *for the first time in the history of the world*, a campaign fought without the occurrence of a single case of so-called hospital disease, pyæmia, hospital gangrene, and the like, I think I may well express my opinion that the Army Medical Officers did their duty, and deserved well of their country, in spite of the unjust obloquy which has lately been heaped upon them, but which time will as certainly remove as it has done in similar cases in times gone by.

In conclusion, I wish to call attention to the difficulties which hygiene has to encounter in time of war. Putting aside the necessary exposure to the vicissitudes of climate and weather, the want of food that may occur, or the insufficient character of the rations, and various other *lædientia*, more or less inseparable from a state of war, there is one very serious difficulty, and that is the great compression of population. The most open order of camps in war-time gives a much smaller space per head than the most crowded conditions in civil life, and camps may be so compressed as to give only 8 square yards or less per head. Each person in London has about 96 square yards, in Paris about the half of this, but to give even the Paris allowance would spread an army over a space too great for military purposes. When, in addition to this, drainage has to be extemporized, and the ground covered with latrines, and when pure and wholesome water is a difficulty, it is little wonder that disease breaks out. It is to those circumstances that the typhoid fever, which has characterized our campaigns in South Africa and Egypt, must be attributed in great

measure, as well as in some degree the dysentery. I would suggest, under such circumstances, that fire should be brought more into requisition and everything be burnt that is combustible. It is a standing rule in camp to burn all rubbish, but I would suggest that all excreta should be mixed with combustibles, such as straw or sawdust, if procurable, and burnt. It would even repay the trouble to carry petroleum for this purpose. Similarly, I would, as far as possible, cremate all bodies, which can be done by means of ambulatory furnaces. Could those precautions be carried out, and all water that affords the least suspicion boiled, we should go a long way towards getting rid of some of the most fatal but preventible diseases which attacks troops in the field. If cholera or yellow fever invaded a force, I should advise the burning process to be rigidly applied to all stools and vomit, and none but distilled water to be issued to the troops, if it could be managed.

Although we are far from having solved all the questions of hygiene or of the causation of disease, there are sufficient principles established to enable us to say that, if the rules already recognized were strictly carried out, we should be able to cope successfully with preventible disease, even under the difficulties and impediments which are inseparable from active service in the field.

MR. EDWIN CHADWICK, C.B.: May I be permitted as an old Sanitary Commissioner to express my very great pleasure at the paper that has just been read, in the extent to which it displays the operation of sanitation in the Army during peace? The progress I think may be marked in this way. Here amongst the Guards, some twenty years ago, the death-rate was 20 per 1,000. The death-rate amongst civilians of adults of the wage class I take is, in or about Westminster, not less than 12 in 1,000. If a man of that class had formerly enlisted in the Guards it would have been at the expense of nearly a double death-rate, but if he enlists now when the death-rate is only 6 in 1,000, or about one-third of what it is in some years, he will gain proportionately in the duration of his life and working ability. I think even including war risks he would be safer than if he remained a civilian. When these conditions (which admit of yet further improvements) are known it should conduce to the abatement of the present very serious difficulty of recruitment. With a completed sanitary service and complete sanitation, men of the wage classes, instead of having to encounter an insurable large loss of life, may have an insurable small one, with the war risks included. It would add to the interest of the subject if the comparative progress that is making in sanitation in the Armies of France and Germany could be got and stated in detail. But everywhere in civil life, as well as in the Army, the obstacles to sanitary progress are the alleged expense of the measures to effect it. Now this great principle should be known, that a heavily death-rated civil population, as also a heavily death-rated army, is an expensive population and an expensive army. I have no doubt if you estimate the expense of the present conditions in India, where the money saving has been during the last decade upwards of five millions, it will be found to be an economy upon the expenses. Take an example from civil life. In some of the slums the death-rates are as much as 40 per 1,000 as compared to 15 per 1,000, to which it has been now brought in the model dwellings and in a number of urban districts. The death-rate of 40 per 1,000 will include 25 funerals per annum in excess, and beyond that, some twenty times that number of sickness, and also of disablement of more than one-fifth of the cases of adults, and a loss of working ability for several weeks. When all these expenses which must be incurred are added up, it is clear that well conducted sanitary operations may be conducted simply for the saving of money quite apart from the saving of pain and misery, and of

premature mortality. What I have said as to the Army is on the progress of sanitation during peace. I should make a large reserve, especially from the last example, as to any great progress made as displayed in the recent war. There is one point I must take a little exception to, and that is, I cannot concur in the results stated with respect to the recent war in Egypt; and I think Dr. de Chaumont has made a mistake which he ought to correct, namely, in spreading the death-rate for eighty days over the whole year. We have at present an Intelligence Department for getting out conditions that will have to be encountered in war. My opinion is we ought to have an Intelligence Department for ascertaining what is the condition of things that will have to be encountered in other countries, and which may cause us three or four times as great a loss as the loss by the sword. If for instance there had been an early sanitary reconnaissance into Egypt, there would have been—several days before the landing, or immediately upon the landing of the force—a knowledge of the unsanitary conditions to be dealt with, and action could have been taken accordingly, and I believe if there had been a good sanitary reconnaissance you would have found that there were camping grounds well known to all the natives, well known to the doctors of the place as being dangerous to encamp upon, while others close by would have been safe. Such an omission may not have been due to any fault of the General; it might have arisen from the hurry of the war. Lord Wolseley has in his excellent manual given very good instructions as to what should be done on those occasions, that he would require from the sanitary officers an examination and a report on the condition of the camping ground, and upon such report he would be governed as to the stations that he continued to occupy. I might illustrate the fatal mistakes committed with the first army in the Crimea, and how they were corrected by the work of the Special Sanitary Commission for the second army, and how, so far as we at present know, the losses that have occurred in the last, fortunately short, campaign, might have been prevented. However that may be, this paper showing the progress that has been made by sanitation during peace, and the yet further progress that may be expected, I deem a good contribution to sanitary science, and I think thanks are due to my colleague of the Sanitary Institute for the pains he has taken, and I only hope that he may have strength and power to continue them for a long time to come.

General R. MACLAGAN, R.E. : There are one or two points in the paper to which we have listened on which I desire to make a few remarks. Some very important observations have been made on what is known to be a very important matter, the accommodation of our soldiers in barracks. With reference to the amount of cubic space allotted to each man, there are circumstances apparently in which great deviations from the rules on this subject are yet not attended with any hurtful consequence. An advantage seems to be gained when the number of men accommodated within one room is small, though they may not have the amount of floor area and cubic space usually considered necessary. In India, on certain occasions when men have of necessity been accommodated for a time in much smaller buildings than are usually allotted to them, but in which only three or four were in one room, it was remarkable how healthy these men were. In one instance at a station on the frontiers of the Punjab when an addition had to be made to the number of European troops, and the accommodation was insufficient, a number of the men were for a time put into vaulted apartments under the barracks originally intended for stores. It was meant to be a very temporary arrangement, the rooms being considered quite unsuited for the accommodation of Europeans. However, circumstances required them to be kept there for a considerable length of time, and as a matter of fact, these men so accommodated were among the most healthy of the European soldiers in that province. It would be a very rash thing to generalize from such a fact, and infer that this was a good mode of accommodating soldiers; all we can say is that there must have been some circumstance there which prevented any evil effect from the reduced space available. One reason, no doubt, was that these apartments were much more protected from the sun by day and from the cold by night. Next, with regard to the lecturer's observations regarding the effect on the health of soldiers in India from being confined within their barracks during the long hot day, while other persons who are not so confined and have much out-of-door

duty enjoy better health—(civil Officers, military Officers, engineers, and others)—it should be noticed that for the most part these civilians, Officers, and others who have certainly a great amount of out-door occupation have that occupation just as the soldier has, chiefly in the early morning and in the evening. Civil Officers are generally as much within doors during the day as soldiers, and often under much more unfavourable circumstances for many hours together in crowded court rooms; and though the Officers, civil and military, may often have occasion to be much in the open air, even in hot weather, their families are always as much confined to the house as the European soldiers to their barracks. Their better general health is due probably to their having better general accommodation, better food, plenty of air in their houses, and other advantages; but not to their being less confined to the house than soldiers. On the subject of the amount of cubic space, I think the lecturer observed that 3,600 cubic feet per man was just equivalent to one cubic foot per second. This seems to imply that the whole of the air is renewed in the course of an hour. That I think can scarcely be assumed. There was one very interesting part of the lecture on the connection of work of various kinds with the health of the troops; and notice was taken of the comparative healthiness of cavalry, artillery, and infantry. It would have been of great interest if the comparison had included the engineer soldiers, the sappers and miners, who are generally so much more employed than most of the other men on out-door work. When infantry soldiers have been employed on public works, as they have frequently been in India on hill roads, their health has been particularly good. The employment has been no less advantageous than the hill climate. May I be allowed, with reference to the remarks of the last speaker, to supplement what I said just now on this subject? There is no question that the occupation of the mind of the soldier, besides being profitable in itself, is one of the most important aids to bodily health. In India, a great deal has been done of late years towards providing this in an advantageous way. The men do not now usually occupy the same rooms during the day and during the night. The newer barracks are double-storeyed. In the lower storeys are the recreation rooms and mess rooms, and rooms in which they carry on various occupations during the day. The upper storeys are the sleeping rooms. In trying times of sickness also, the occupation of the mind is most important. On the occasion of a sudden outbreak of cholera among our troops in India, it is found best to move the men at once out into camp or temporary shelter, even at a season when they would never, under ordinary circumstances, be put under canvas, and the immediate occupation of the mind in making the move, the roughing it, the inconvenience serves perhaps as much as the mere change of place and air to fend off the attack of that terrible disease. We have reason to be glad that this subject has been brought before us so fully as it has in the lecture to-day. It is a subject not second in importance to any of those discussed within these walls, affecting so directly and closely as it does the efficiency of our Army.

Major-General DUNNE: Following the Officer who has just spoken with regard to the troops in India and their being kept all day long in their barrack rooms, I may mention that at places like Fort William, in Calcutta, it would be absolutely impossible to allow young troops any freedom, comparatively, of going about in the day in hot weather. My own experience of India as a young man was that a great deal of the sickness amongst infantry when they are first put into barracks in India arose from the fact that they had a large amount of meat and used to drink a large quantity of beer, and that they had nothing in the world from morning to night to amuse their minds. They had no occupation from breakfast time in the morning until 5 or 6 o'clock in the evening. I have no doubt the Officer who last addressed us will corroborate this, that the infantry soldier did nothing but eat a big dinner and then tuck himself under his mosquito curtains and snooze away half the afternoon. I think if more indoor recreation could be found for the men, great improvement would result. No doubt, of late years there has been more occupation found for them. But I think they should not be allowed to go about in the open in the heat of the day. Soldiers could not be trusted—they would have sunstroke over and over again; but to amuse them and give them occupation in barracks is the best thing for them. No doubt why the Engineers are a more healthy body of men in India than the infantry is for the

simple reason that their minds are more occupied and there is more work for them to do during the day.

Colonel BAYLIS, Q.C. : I venture, not being myself one of the regular army, to make a few observations, but with considerable diffidence. Most useful practical suggestions have been made, and they are founded upon the best of statistics. Are these useful measures of prevention to go on? We trust that this lecture will not be without its fruits. We are sorry to see so few attending a lecture of such general importance not only to the Army but to every one. I can only account for it in this way: if you talk of measures of prevention to persons, they are always somehow or other loth to follow them; it is only when something overtakes them with great severity that they will attempt to do anything in the future to prevent its recurrence. And I am not clear but this is the cause of it: it is found that the more successful measures of prevention are somehow or other the less do they appear to be needed, and the less are they followed up by further reform. People do not look at results sufficiently; they say the world is working very well, but they do not look sufficiently at the cause of its working. Now we all allow that a great deal of the present improved sanitary state of the Army is due to precautions which have been taken; and we only hope that the effect of this lecture will be to follow up what has been done and to let these practical suggestions be carried out. The lecturer attributes a great deal of mischief to the tight dress worn in the Army. We know that with ladies appearance goes a very great way, and so it seems to do in military matters. I hope, however, that some practical result will come from this lecture, and that it will be seen that the first consideration is to make the Army healthy and thereby effective. We must all also admit that the occupation of the mind has a great deal to do with the health of the body. I hope, therefore, we shall look after the *mental* occupation of the Army. If whilst doing that, we give the men as much opportunity as possible for following active and healthy pursuits, physical and mental, we shall find less disease and they will not have recourse to those things which so often bring on disease. The suggestions as to the selection of camp sites, and taking precautions beforehand, I think are most important, and I venture to hope they will be carried out.

Dr. DE CHAUMONT: I should wish to say a few words in reply to some of the remarks that have been made. In the first place with regard to what has fallen from my friend Mr. Chadwick on the subject of the statistics of the Egyptian campaign, he must allow me to correct him, for he has not quite apprehended what I have stated. I stated that the total number of deaths from disease during the period of 87 days was 74 out of a total force of 13,000. Now if that is taken as a ratio for those 87 days alone, it gives a ratio of 5·88 per 1,000. But if I expand that ratio to a whole year, that would come to 320 deaths, which upon the 13,000 gives the ratio which I gave of 24·67 per 1,000, and I do not think it would be possible to make it any more. I expanded it for a whole year by multiplying the deaths in the ratio of 365 divided by 87, and that gives 24·67 per 1,000, which I think is an extremely small ratio for a campaign fought under such very adverse circumstances. With regard to the remarks by General Maclagan and also Major-General Dunne, I quite agree that a great deal must be laid to the occupation of the mind of the soldier, and there are no doubt many causes of unhealthiness other than mere confinement to barracks, but speaking of the time of my own experience in India, which I am sorry to say is nearly a quarter of a century ago, there is no doubt at that time men were confined to barracks the whole day and the air was extremely foul, and I think I was able to trace the bad effects of it in the general health of the men. Of course if the men are sent to another room to pass the day it is a good thing, but the main objection I was bringing forward was that the men were confined to barracks in an improperly ventilated air space, which they were again compelled to occupy during the night, and I still maintain at that time the remedy was worse than the disease. The men would not have suffered so much if they had been allowed the utmost freedom in the open air. Of course if it is found that men cannot be trusted to protect themselves from the sun there is no doubt precautions must be taken to protect them, but it must be done in an intelligent way,—in such a way as shall be an advantage to the soldier and not a disadvantage. There was one remark that General Maclagan made with regard to the

amount of fresh air which I suggest as being necessary. He said that this would demand that the whole air of the barrack should be changed every hour. But we not only demand that, we demand three times that. Even in the present day the limited demand of the Barrack Commission is that the air shall be changed in every room at least twice in the hour in order to give a man 1,200 cubic feet. He gets 600 cubic feet of space, and if he ought to have 1,200 cubic feet of air the air must be changed twice in the hour, but we say the air *may* be changed three times in the hour. I think it is quite possible we may get increased space and 3,600 cubic feet per hour for the soldier by-and-bye. And this brings me to another point that was referred to also by General MacLagan, namely, that the case has occurred more than once where men have been placed under apparently adverse circumstances, as for instance where they have not been allotted the full amount of cubic space, and yet have maintained very good health. I do not deny that at all; I think it is quite likely, but other circumstances must come in, and I would here point out what is very often forgotten, or not understood, that cubic space itself is no substitute for ventilation, that is to say what we want is that men should have fresh air delivered to them; it must be delivered in such a way as will be without injury to them in the way of chilling them, or being otherwise unpleasant, but they must have a certain amount of fresh air, and it is perfectly immaterial how it is given, but under no circumstances can cubic space ever be permitted to take the place of fresh air. Many men think if you put the men in a large room, that is all that is required, but if you occupy the room for a few hours shut up, it will be poisoned just as much with 10,000 cubic feet as if it were 100. If it is impossible to deliver a sufficient amount of fresh air and a man occupies only 600 feet of space, it is obvious you must give him more, but this is merely with reference to the practicability of a continuous delivery of air. A man may keep his health perfectly if he is only occupying 100 square feet of space if he could be provided with a sufficient number of cubic feet per hour, or he might attach a respiratory apparatus to his mouth and nostrils, and in the foulest atmosphere you might keep him alive and healthy by bringing fresh air to him and taking away the foul air. The cubic space is quite a side issue with regard to the actual ventilation, so that in these cases where men have been apparently crowded together, in all likelihood the fact has been that there were large openings through which fresh air could very easily be brought in. Men are very often crowded together in the open air, and if the crowding is not too excessive they may keep their health. I might have added, as has been suggested, the statistics of other armies, but it would have rather prolonged the lecture. I may merely mention that the experience of our own Army is by no means unique, and that if we study the results obtained in the French, German, and Austrian Armies, we find that the same conditions produce the same evils, and the same remedies have produced similar results. The death-rate in the French Army has been reduced at least one-half both in France and in the Colonial service. In Germany and Austria the same thing has occurred; with improved measures of sanitation, especially improving ventilation and sewer arrangements, they have got rid of a very large amount of disease, but there still remains the instructive fact that in the foreign Armies there exists a very large amount of preventible disease that we are gradually getting rid of. For instance, typhoid fever is only too common among the French soldiers. Anyone who has experience of the abominable way in which the excreta or sewage is dealt with in France will easily understand why this should be, and why such diseases as typhoid, diphtheria, &c., should rage in foreign cities when they are a very small item in the death-rate here. I will just remark with regard to this, the difference between what we do in this country and what is done abroad. My friend Dr. Ballin, Professor of Hygiène at the Val de Grâce, told me the conclusion he had come to was this: "Your streets" he said, "in your cities, particularly London, are filthy dirty, and your sewers are simply abominable, but your houses are admirably clean, and you have a copious supply of water, and therefore you are healthy. In Paris," he said, "our streets are beautifully clean, you might have a dinner party in the sewers; but we keep all the filth in our houses and the water supply is totally insufficient: the result is we are decimated with disease. After all," he says, "your system is the best" and I think we may say so too.

The CHAIRMAN: I cannot pass over the discussion which has taken place on this able paper of Dr. de Chaumont's without adverting to a subject with which, however, he does not deal at all, and that is camping. Mr. Chadwick has stated that there is great fault to be found with camping ground in Egypt. I need hardly tell my audience here that an army in the field cannot always choose its camping ground; it must camp where its General wants it. I must say, however, from what I have heard both here and elsewhere regarding the selection of the camping ground at Cairo, that the only camping grounds that could have been occupied were those which were occupied, and that the authorities who determined to camp the troops in the place where they were encamped at Cairo had the very best information on the subject, namely, the advice of the Khedive of Egypt and his staff. I feel it necessary to say this in justice to the advisers of the General and to the General who commanded the Army in Egypt, than whom I fancy there is no more competent sanitary or strategic General perhaps in our Army. I think it right also to say that the Army was well advised by a very competent sanitary Officer who was on the staff of the Quartermaster-General in Egypt. With regard to the paper, I have one single remark to make, and that is that the whole of this admirable narrative, based as it is on statistics which do not admit of being disputed, shows if anything can show clearly and very logically too, that we are certainly on the right road to secure for our Army the best possible health consistent with the conditions under which soldiers must serve, and, therefore, I hope that the result of this admirable lecture, containing as it does information on the subject given to us in previous years by the same author, will be that the Government will be stimulated to continue those sanitary efforts which have done so much for the health of the Army, and for the saving of life in the Army, and that thus the ranks of the Army will become more and more popular and its efficiency more and more marked. With these very brief observations I would ask you to give our distinguished lecturer a very warm vote of thanks. Although our audience here is a limited one, yet it is a very influential one, and when it is borne in mind that this lecture through the medium through which it will be published will address itself to almost every Officer in the British or Indian Armies, I have no doubt that you will think that the hour devoted to the consideration of this subject this afternoon has been extremely well spent.

Friday, June 29, 1883.

COLONEL THE EARL OF WEMYSS AND MARCH, A.D.C.,
in the Chair.

MAGAZINE RIFLES AND REPEATERS.

By Lieutenant-Colonel G. V. FOSBERY, R.C.

It is now little more than a year since I appeared before you in this theatre¹ to advocate a change of armament, demanded in my opinion alike by the increase of our mechanical knowledge, the new elements introduced in the art of war, but beyond all by the serious steps taken or contemplated by our neighbours in the same direction.

I advocated, as you may remember, such a change with considerable hesitation, knowing as I did how weighty were the opinions which ranged themselves on the side of the *status quo*, and I put forward the views I myself entertained, asking you rather for serious consideration and careful criticism, than for any unqualified assent to my propositions.

I was gratified as well as surprised to find how large a number of those then present gave me their adhesion, and agreeing to the broad principle for which I contended, only differed, when they did differ, as to minor details and the classes of arms which should have the preference. The subject, moreover, seemed to possess an interest for which I confess I was unprepared, and I have been thus encouraged to bring before you to-day some account of the progress since made both here and abroad, and give such information as may serve to keep us properly posted up in the whole question.

That infantry training and instruction is receiving at this moment earnest attention is proved by several indications. Now, as this training must precede and accompany any change of armament, unless indeed we are content to throw away our money altogether, or accept for it but a fraction of its value, it may not be amiss, before commencing our study of the arms themselves, to glance at the character of the training on which will depend their practical value in the hands of our soldiers. At this time last year you may perhaps remember that I pointed out how inadequate would be any supply of service ammunition which any Government would consent to pay for, to give the soldier that perfect command of

¹ See Journal, vol. xxvi, No. CXVI.

his weapon so necessary to him under the changed conditions of war. Following, though independently, in the steps of Major Brooke, I strongly advocated the use of the Morris tube, or some equivalent of the same, as the only really practical means of getting what is required. I am glad to learn that by this time its introduction into the Navy has been definitively commenced, and that before long it will probably be in the hands of the Army also. From the results which have already been gained by its use, we may, I think, fairly reckon on its leading to a degree of expertness in the use of the rifle such as has never yet been obtained, and that one of the stock objections to a change of armament, viz., that our men already carry a gun which is far too good for them, will in future be less often cast in our teeth.

But we must not forget that if we are to gain these advantages, the Morris tube must be put to its proper uses under proper supervision and carefully framed instructions. If the contrary is to be the case, it will remain a mere toy, of little practical use, and likely to confer no substantial benefit; used as it should be, it becomes a scientific instrument of the highest value, and may be made to effect as striking a change in the quality of small-arm fire as was that initiated by the efforts of Hay and Wilford. This may sound like an exaggeration, but I do not believe it to be so, and I will explain my reasons. Of course I know from my own experience as a musketry instructor what the temptation will be, viz., to use the tube to get improved shooting at fixed targets, to help lame dogs over the stile, to push forward stupid recruits or incorrigible third-class shots, or give a finishing touch to the probable marksmen of the battalion, for which purpose any amount of ammunition will willingly be paid for by Officers or men. Pleasant little rifle matches at wafers on a wall, or what not, will be got up in rainy weather, and altogether the tube will make a certain general improvement in the ordinary range practices, and be a source of amusement into the bargain. But if this is all that comes of it, we shall not have made a single serious step in the direction in which progress is most urgently required—I mean that of *field* shooting as distinguished from *garrison* or *siege* shooting, which is mainly what we now devote ourselves to, that is to say, practice at fixed objects from fixed positions, as distinguished from the fire of moving men directed on men or horses, themselves also in motion. How many amongst our best shots can hit a rabbit running, with a rifle, put a ball through a bird on the wing, or even a hat thrown up in ever so easy a way? Not one in a hundred, and why? Not because the thing is either impossible or really very difficult, but partly because from our living in an inclosed and densely populated country, no one has or can have the means of practising these things. The eye is quick, the rifle true, the hand can be trained to anything, and the object five times, let us say, the size of the carton we should be ashamed to miss at 100 yards, and it is only 20 yards off. What, then, is the matter? It cannot be only want of practice that makes the man miss every time. Is it not mainly because the object moves, and that too quickly for the slowness and deliberation at which our

training stops short; a great deal too quickly for our instructions to get the eye well down to the bottom of the notch of the back sight and see the tip of the fore sight aligned with the centre of the object, to feel the butt is well pressed into the hollow of the shoulder, the breath held, and the trigger squeezed, till the rifle goes off, special care being taken not to wink with the right eye?

Not that all these things are not excellent and necessary things, but that they are only the spring drills, the extension motions and balance step without gaining ground, of rifle shooting as it should be, and sooner or later I feel sure will be, taught to the soldier.

His position in going into action as it is, is much that of a man who should be carefully put through aiming drill, position drill, and the rest of it, together with all his standing firings—with a double gun—and then be sent out after a jack snipe, under pain of death should he fail to kill it.

We take him as far as the stuffed partridge on the top of a pole; and when he has blown it to bits, we leave him to do his best in the turnips.

When I say this do not, I beg of you, suppose that I for a moment think that we can afford to neglect the goose-step, or that parade-marching is unnecessary, or that without both of them, and plenty of them too, we could approach our enemy with precision, or manœuvre with confidence in his presence.

What I want to express is my conviction that when we have trained our men at fixed targets only, and at regulated distances, we have got no further than the goose-step of rifle shooting, and have still all the rest to learn.

Do what we will, in action we must keep moving, and as a rule the enemy does the same. Thus the man who knows nothing but what he has learned on the ranges must inevitably waste his ammunition, and he does it too, to a degree which, but for reliable statistics, would be simply incredible.

We have, therefore, to take him a step further; up to the present time, for reasons before mentioned, it was impossible to do so in this country. But the Morris tube now, once for all, removes the difficulty, *i.e.*, it enables us to have plenty of the practice we want, and do it safely, and if we will only use it in the proper manner will enable us to complete the remaining steps of our training, which would be pretty much as follows:—When the man has been so far taught and practised that the movements of rifle, hand, and eye are made instinctively and naturally, and when he can make fairly certain of a fixed target, he should be taken to snap shooting, not haphazard at anything that moves, but first at disappearing targets, which will give him only a certain time in which to get his aim, and so teach him to get it quickly, and fire when he has got it. When he has learned this much, then let him be taught to fire at objects of the size and character and animated with the same speeds as those he is likely to encounter in war. Miniature targets should be devised, representing, for example, a horseman at the gallop at 100 yards, a battery at the trot at 1,000, a man running at 50, or a company in motion at 1,500,

or upwards, &c., and when the soldier is able to give a satisfactory account of such objects as these, and has really conquered the difficulty of firing at moving objects, then the more hats or halfpence he shoots at the better.

As I said before, without the tubes we could never have taken this step in advance at all; and if only now, when we have got them, they are kept for this their legitimate object we may with confidence look forward to an increase of efficiency in our infantry fire, the value of which it will be impossible to over-estimate.

At present no one seems to know much about the time of flight of the bullet at different distances which, when properly combined with a knowledge of the rates at which an enemy moves across the range, permits us to make such an allowance as will cause (as Colonel Wilford used to put it) the man and the bullet to arrive at the same spot, and at the same instant of time.

Nor would I burden the soldier's memory with such details as that the Martini bullet takes 1.46 seconds to go 500 yards, or 9 seconds to travel 2,000, but I would train his eye by moving targets of a carefully regulated size and speed to appreciate and remember the different allowances necessary, according to the appearance of the objects before him and their apparent motion.

Let us not imagine this is easy to do. Nothing worth having ever is easy, but I maintain that, although much opinion to the contrary has been strongly expressed, it is fully worth all the time and labour we could bestow on it. For I cannot believe that chance fire, *i.e.*, the fire of mere drill, can be as effective in the field as aimed fire, *i.e.*, the fire of drill combined with education.

I know that some good German authorities hold an opposite view, and assert that the mass of fire, and the time in which it is delivered, are the things to which regard is mainly to be paid; equivalent to saying that if only you let off enough guns where there are men about, sufficient accidents to answer your purpose will very probably occur.

We read that a certain man drew a bow at a venture and smote the King of Israel between the joints of the harness. That is to say, made the very best shot it was possible to make, and at the very man it was most desirable he should hit. But we should surely think it not a little remarkable were we to find that the drawing of bows at a venture had been recommended in consequence ever after.

Our own supremacy gained by the use of the same weapon at all events depended on the very opposite principle being inculcated, and what is true of one projectile weapon applies equally to all: with the exception of the Boers, we are now perhaps as a nation the best rifle shots in the world; surely, we should maintain this superiority by every means in our power.

By this time you will probably wonder what all this talk, true enough in its way, has to do with the special use of the repeater or magazine gun. It is this: we all have heard a broad distinction drawn, when speaking of the rate of fire of any weapon, between fire and aimed fire; for instance, in the case of the Martini we are told that

the gun has been fired by a single individual 30 times in a minute, that occasionally expert men with some practice can fire it from 22 to 23 times a minute, but that aimed fire can be carried on at but the rate of from 12 to 15 shots in the same time, and as I told you last year in some practice at moving targets only about 5 shots were got off. I have tried in several ways, while preparing this paper, to ascertain what the real rate of fire of the Martini-Henry is. Opinions vary, but I have every reason to believe that taking our men all round at fixed targets, and at 200 yards, its speed does not much exceed eight shots per minute, and at moving objects would be still slower.

Now all this *must* be wrong, these differences should not exist to this extent, and where are we to look for the remedy?

We may, I think, assume that the difference only depends in a small degree on the time taken to load, all men being drilled to do this in about the same time; depend upon it, it is on the time taken to aim in doing which the utmost deliberation is inculcated, and in which of course at fixed targets any amount of time may be freely taken.

What is the consequence? Here it is that all the delay takes place, and here at the fixed targets are manufactured what I called in my last lecture *poking* shots.

Who has not seen an unfortunate 3rd class victim come up to the targets wanting but a couple of points to get him out of his class? Who has not watched him set his teeth hard and aim till his legs trembled under him, and finally snatch at his trigger in sheer despair, and send his bullet to the moon, being immediately afterwards remanded, of course, to *aiming-drill* for the term of his natural leisure?

But all the man wanted was to be taught to catch his sights quickly, and fire as soon as he caught them, and he would have shot as well as any one. Nor is the mischief by any means confined to such men as these. I've seen dozens of so-called crack-shots (at fixed targets be it understood) dwell long enough on their aim to let a deer get a field off, or a partridge into the next county.

This deliberation is rightly enough inculcated in preliminary instruction, and the earlier firings at fixed objects, but it must not be allowed to form a habit than which none is more fatal to good field-shooting, and it is mainly to such exercises as these which I now advocate that I look for its eradication or correction. If I am right, the bearing of all that I have said is connected directly with the repeater question, for with the repeater the time of loading is reduced by at least one-half, and often much more than that. If now we are able by appropriate and careful training not only to make our men fair average shots at moving objects, but by the same operation reduce the time now uselessly occupied in a hesitating or over-deliberate aim, we shall at once reap the full value of the new weapons without further trouble, increasing the weight of fire thrown in a given time to a degree satisfactory to the German theorists, and improving its value in accuracy sufficiently to fulfil our own requirements.

So far for our own preparation for a change, and what still remains to be done: let us now proceed to inquire what our neighbours have been about, and I will then examine into the magazine-gun question somewhat further, and consider, so far as a *layman* may, the various points we should look to as guides in the selection of a suitable repeater for military purposes.

So far as I am able to learn, the whole question is still in an experimental stage, more or less advanced towards decision in the various countries of Europe.

In France the adoption of such a weapon is at this moment under serious consideration, for although, as you know, the marine corps are already supplied with the Kropatchek in large numbers (some 30,000), this weapon is considered in several ways unsuitable for troops of the line, and a Committee is at this moment sitting in Paris, before which almost every known form of repeater has been brought for consideration.

At St. Petersburg a Committee has been formed, or is shortly about to be so, although (as, perhaps, you know) the Russian Navy already carries large numbers of the Evans repeater, the butt of which contains somewhere about thirty-five cartridges, or seven more than the average number expended by the Prussian army in the whole of the Austro-Prussian campaign.

Spain has selected three types of gun for further trial.

Austria is experimenting with an extremely small-bored rifle, and has examined and reported on the Schulhof (see Plate, Fig. 2), Mannlicher (Fig. 3), and several other systems.

Sweden is dallying with the Jarman gun, and the Norwegian Navy carry the Crag-Petersen.

Italy has a repeater, I believe the Vetterli, in some numbers in her fleet, but is looking for something better for both it and her land service, and having got her credit, will probably soon come to a decision.

Switzerland is at last dissatisfied with the Vetterli, and wants something new, and Turkey, as of course you know, has a large number of Winchesters.

But of all the European Powers, Germany has taken the most decided and practical step, having ordered 2,000 Mauser repeaters, which she has distributed 500 to each of four regiments, selected from the different nationalities of the Empire, and awaits their experiments and reports before taking further action.

America shows no less common sense; she has ordered after exhaustive trials of all the systems presented to her, a certain number of each of the four which finally came out highest, but as yet the orders, so far as I know, are not completed. Of other States I have at present little or no information save that this much is certain, no one Power in Europe can afford, or will dare, to be behind-hand in this matter when once the others have commenced arming with the new weapons, and all seeming hesitation will give place to serious activity so soon as any one of the great Powers shall have definitively taken the matter in hand.

DIAGRAM OF 500 YDS TARGET MADE AT ENFIELD JUNE 1ST 1883.
WITH NEW 400 BORE ENFIELD MARTINI RIFLE

FIG. 1.

N.B. N° 3 shot was carried to the left by a puff of wind.



Vertical dimension of group 9 inches.
Horizontal ——— 4 ———

FIG. 4.

SPENCER-LEE MAGAZINE GUN.

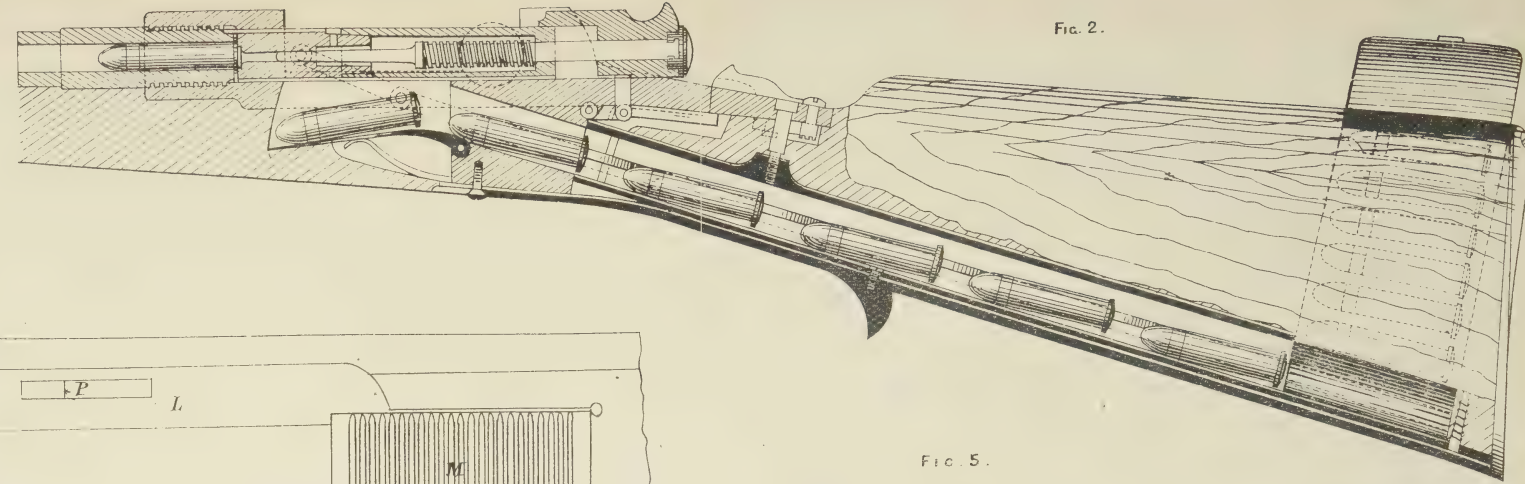


FIG. 2.

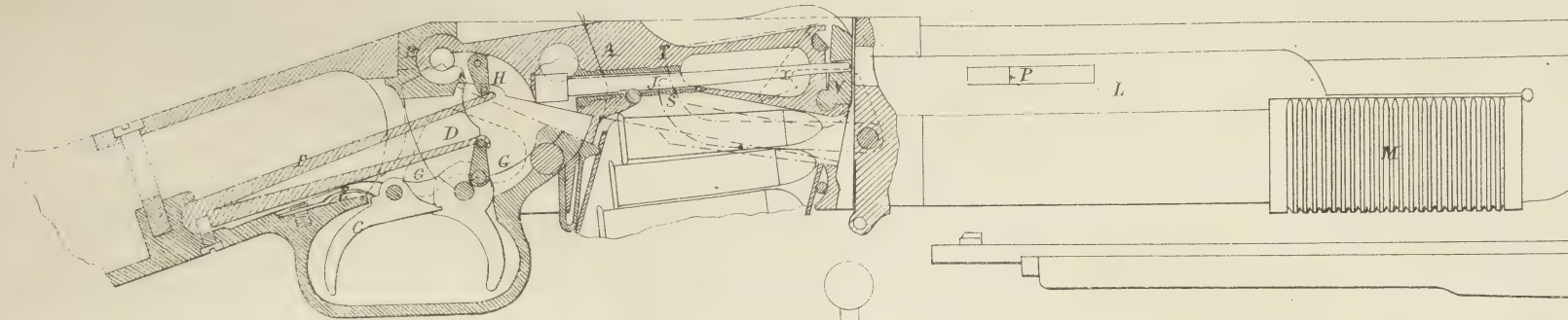


FIG. 3.

MANNLICHER REPEATER.

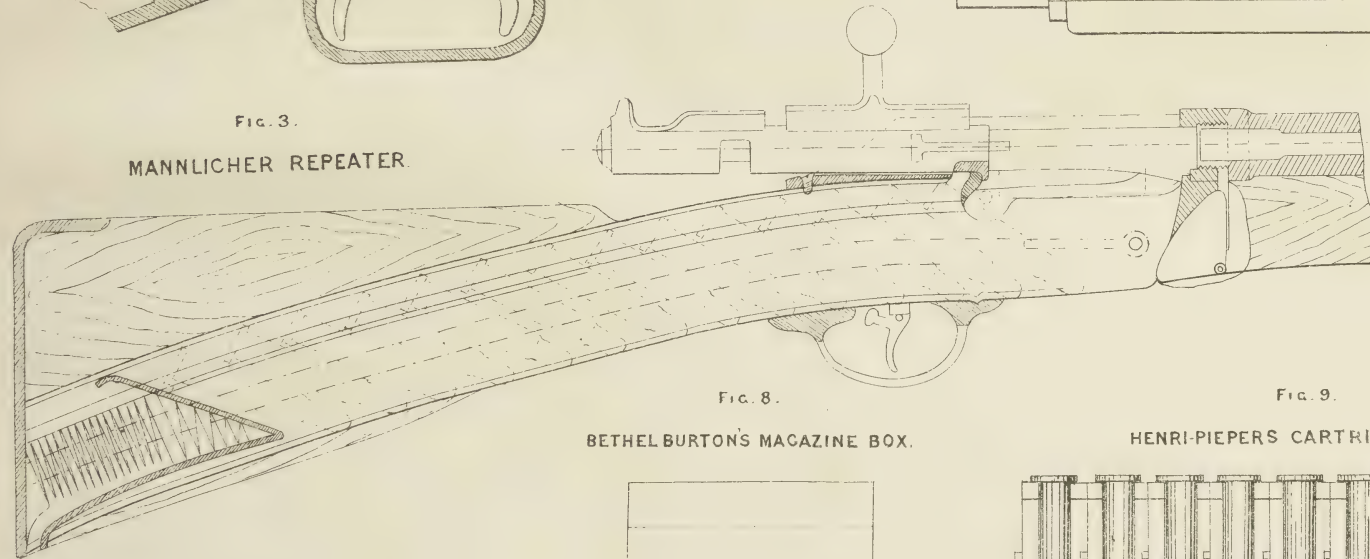
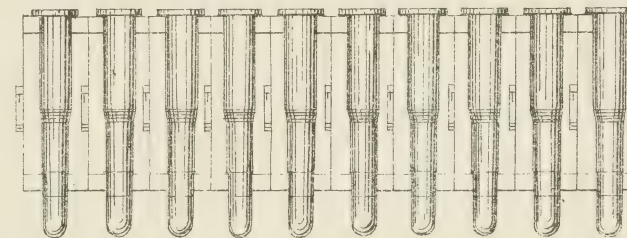


FIG. 8.

BETHEL BURTON'S MAGAZINE BOX.



HENRI-PIEPERS CARTRIDGE CHAIN

FIG. 10.
PIEPERS ELECTRIC CARTRIDGE.

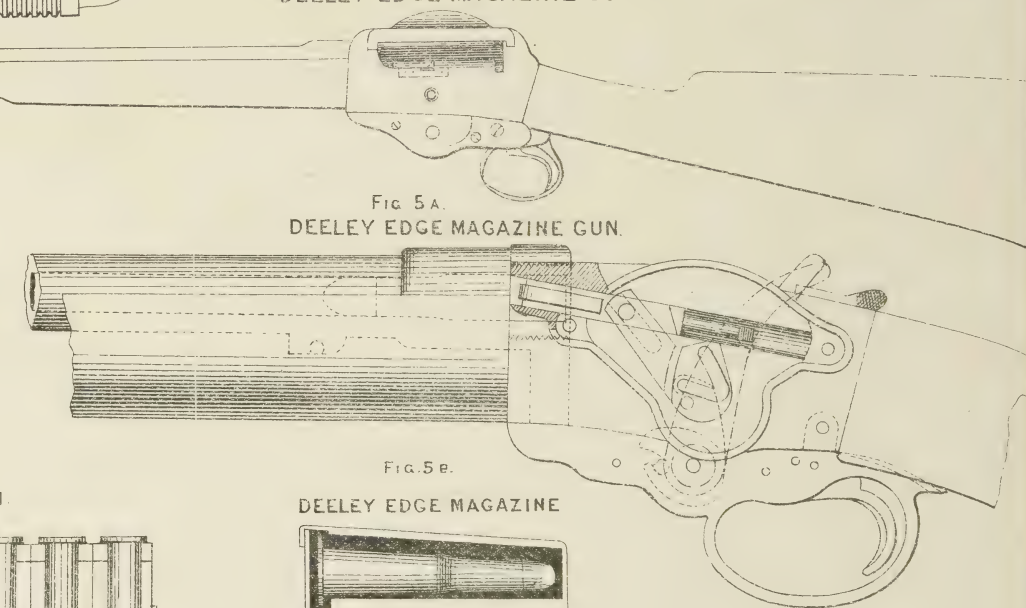
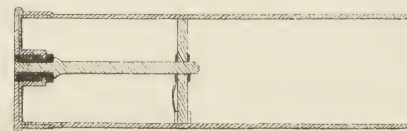


FIG. 5.

DEELEY EDGE MAGAZINE GUN.

FIG. 5A.

DEELEY EDGE MAGAZINE GUN.

FIG. 5B.

DEELEY EDGE MAGAZINE

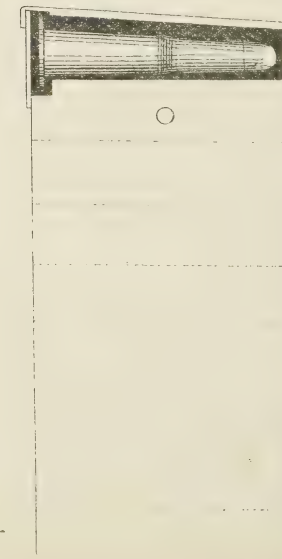
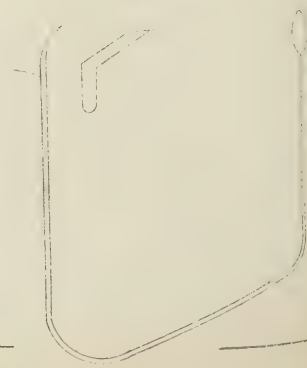
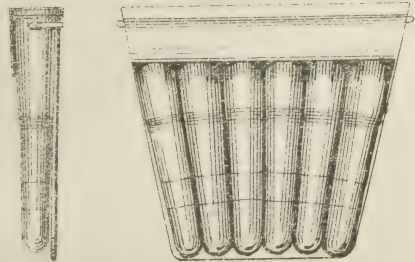


FIG. 7.

LEE MAGAZINE.



COL. FOSBERY'S CARTRIDGE HOLDER



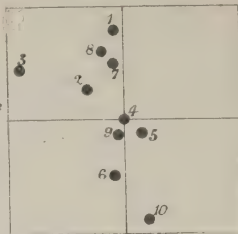
Side view.

Front view.

DIAGRAM OF 500 YDS TARGET MADE AT ENFIELD JUNE 1ST 1883.
WITH NEW 400 BORE ENFIELD-MARTINI RIFLE

FIG. 1.

N.B. N^o 3 shot was carried to the left by a puff of wind.



Vertical dimension of group
Horizontal — " —

FIG. 4.

SPENCER-LEE MAGA

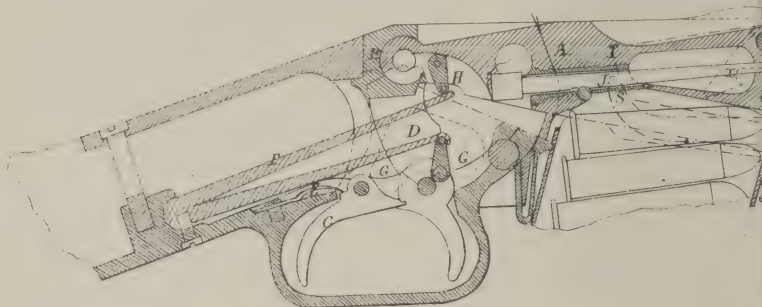


FIG. 3.

MANNLICHER REPEATER.

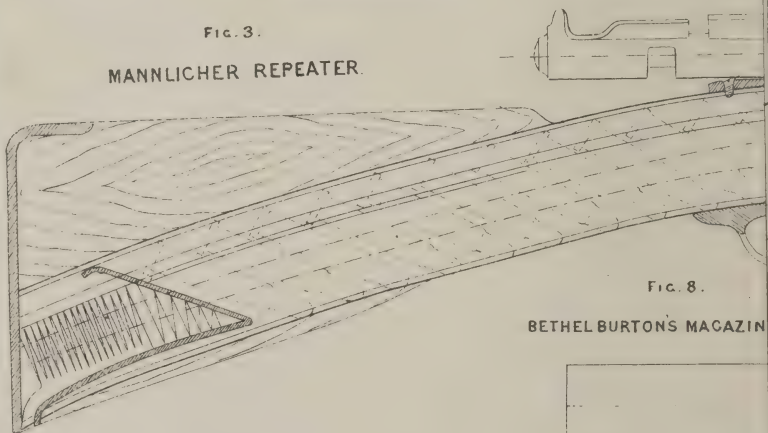


FIG. 8.

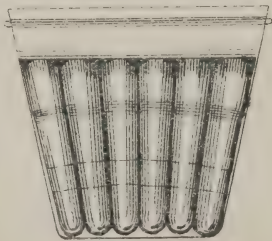
BETHEL BURTON'S MAGAZIN

FIG. 6.

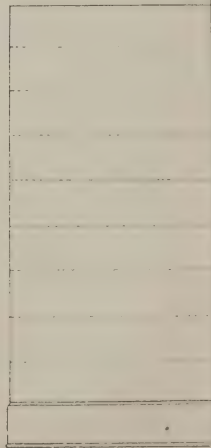
COL FOSBERY'S CARTRIDGE HOLDER



Side view.



Front view.



As for ourselves, it was thought, I remember, at the time of my last lecture, an unfavourable symptom that a new type of Martini of small bore should have been introduced and experimentally issued in small numbers to our School of Musketry, training-ships, and some few regiments of the Guards, and others. This, however, was by no means the case, and the experiment has been used to settle approximately many questions of bore, barrel, and cartridge, all of which required careful consideration and no inconsiderable experience before the most suitable conditions could be selected for the weapon of the future. So far have these trials been carried, that the bore, the rifling, the weights of lead and powder, and some other details of wad and lubrication, may be said to have been definitively fixed; and to judge from a target of ten shots made at Enfield last week, in which every shot at 500 yards was included in a parallelogram of 9 inches by 4, it would seem that there can be very little more to be desired. (See Plate, Fig. 1.)

The cartridge question (always a most difficult one), was in old times settled solely with reference to the requirement of breech-loading small-arms; it must not be forgotten, however, that the machine-guns already issued to the Services now control its length, and that even its diameter and form may have to be modified, in order to make it pack symmetrically and easily in the magazine selected for the new weapon, whatever that may be. Side by side with these experiments, which have been most thorough and exhaustive, a Committee has been at work on the magazine-gun also, and will probably have concluded its experiments and be prepared to make a final report by the end of the present year. Thus it will be seen that no time has been lost—that a most important part of the inquiry is all but terminated, and we may congratulate ourselves on being in these matters fairly abreast of our neighbours, or at least in such a position that no one of them, were they to make the attempt, could get far ahead of us in this matter of re-armament.

We may feel sure that the Magazine Arms Committee has by this time eliminated many of the systems which have been so largely championed by sanguine inventors or half-informed amateurs, and that many a gun is already weighed in their scientific balance and found wanting.

But, if this be the case, it is equally certain that the Committee is bound to recommend as well as to condemn; and should no one invention fully satisfy their every requirement, to construct and combine also, so as to obtain the most perfect weapon possible for the country.

Now this is a process which is eminently distasteful to the individual inventor, and I have heard the strongest language made use of in its condemnation. A little thought, however, will show us that under most circumstances it is allowable, and under many a matter of absolute necessity. As a matter of course the necessities of the State must override individual interests or susceptibilities where the two are brought into conflict, and that they generally will do so in cases such as this, is equally certain. No man, as a rule, can be the sole

possessor of all the best ideas or contrivances to attain a given object, and many inventors are compelled to make use of inferior combinations to avoid trespassing on the domains of others.

Thus, in this very case of magazine arms, one will have a perfect bolt or lock combined with an inferior magazine or a faulty extractor; in another the magazine will be all that is desired, but the firing mechanism weak or preposterous; and so on through the various parts which go to make up the weapon.

Under such circumstances, I hold that a Committee which would fail to make the best possible combination from the different parts brought before it would signally fail in its duty. And so long as the author of any important element adopted is justly and honestly credited with his proper share of the whole and proportionably rewarded, I fail to perceive that he has much cause for complaint.

This, of course, renders it more probable that with the large number of weapons now in the country, many of them of singular merit, some magazine arm, either simple or cross-bred, may ere long be produced to challenge our criticism or command our favourable verdict. Anyhow, it is safe to say that the days of the single-loader are now at last fairly numbered, which is a good deal more than could have been asserted with any degree of confidence at this time last year; and to us who believe in the great future of repeaters this is very encouraging.

At that time, as you will remember, there were far fewer repeaters known to the world than there are now, and our consideration was limited to a very short list, mostly composed of old and well-tried inventions, or to a few details of some one or two of the newer systems then just coming into notice.

The case is now different, certain conclusions as to many of them have been arrived at, and new methods of cartridge arrangement and supply have been devised and perfected, which from their very nature put older and less effective ideas wholly out of date.

Thus, in considering the magazine arms of to-day, I may, I think, finally dispose of and exclude from my category all such as contain a column of cartridges in a tube, and actuate them by a spiral spring, whether the tube be placed under the barrel or in the stock. We thus dispose of all such guns as the Winchester, the Mauser, the Kropatchek, the Hotchkiss, the Ball Lampson, Spencer, Vetterli, and a host of others, *quos enumerare longum*, the reason for this exclusion being the possible danger and the certain inconvenience of the arrangement; such guns being amongst other things slow and troublesome to load, and whether or no they risk exploding their magazines, always more or less damage their bullets, and injure their powder by the jolting and compression to which the cartridges are subject in the tubes. This preliminary weeding out, rough as it is, is yet I am sure reliable, and vastly simplifies the task of examining the weapons amongst which the probable rifle of the future, or perhaps I should say the principles on which the rifle of the future will be constructed, may be expected to be found. For once the spring tube under the barrel or the spring tube in the stock are discarded, we

have but two or three places in which to carry our supply of ammunition, and but one or two methods of arranging it there.

For instance, we may place our cartridges vertically in a single row, one above the other, or diagonally as in the Mannlicher rifle (see Plate), or again in a tube if only they are separated by the mechanism which brings them up to their work, instead of being placed in contact and driven by a spring. Then the vertical box may be placed on the side of the gun wholly above the axis of the barrel as in the McEvoy Mannlicher and some others, under the centre and wholly below the axis as in the Spencer-Lee and another form of the Mannlicher; or again partly above and partly below as in the Bethel Burton gun, the Perry quick-loader, my own attachable magazine (Fig. 4), and a new rifle by Deeley Edge (Fig. 5), which I have not yet seen in its completed form; or on the other hand, the vertical box may be placed in the butt as in the Schulhof, the cartridges being brought up separately by simple ratchet mechanism, through such a tube as is employed in the Chaffey-Reece, or again the Chaffey-Reece's tube may be employed alone as in the weapon of that name; in this case, however, it has the serious disadvantage of being slow to load, and moreover being capable of containing but very few cartridges.

The diagonal butt tube of Mannlicher is the only other way in which to my knowledge cartridges can be stowed conveniently in the stock, and here the supply is ample, and though the inconveniences of loading are now the same as those attaching more or less to all tube guns, this admits of a remedy. In this connection I cannot help, notwithstanding all I have seen and heard since last year, adhering very thoroughly to the opinion I then expressed, that a magazine gun to make it worth our while to adopt it, should contain at least ten cartridges; with this number every ordinary contingency of war requiring the use of the magazine could confidently be encountered, with less, I do not hesitate to say no consideration of mere sightliness or convenience should induce us to be satisfied—unless indeed for a gun containing a smaller number, some method of loading *en bloc* should be discovered. I will admit that the problem is a difficult one, and one satisfactorily solved in no gun I know of with the exception of the Bethel Burton which I brought to your notice last year. But it is certain that, should the magazine gun be finally adopted, the present method of carrying our cartridges must be abandoned, unless we desire to content ourselves with a weapon far less really serviceable than it can be made by this means. I do not propose to recommend any particular way of doing this, but you can see for yourselves the inconvenience of the present method; watch for instance the preparations necessary before making a range trial of any of the magazine guns you know. First the cartridge packets in sufficient number are laid out on a table, then they are untied and opened out; then the cartridges are carefully arranged with the heads one way and the tails another, and finally they are picked up one by one and either forced through a trap in the stock, pressed against a spring into a box, or dropped singly into a grooved receptacle somewhere about the gun.

This is all very well, and in the hands of the experts who generally show off these weapons, looks easy and simple enough, and once the firing begins one is apt to be too much astonished at the effects of the repeater in any form to be too critical about preliminaries. Let us, however, change the *personnel* and surroundings a little and see what will happen.

Let us take away the table and put the rifle into the hands of A.B. John Evans of Her Majesty's Navy, and leave him to recharge his magazine in the top of his ship in a blow of wind, or sitting on the thwart of a cutter in a sea-way with wet fingers, the spray flying about his ears, and the motion of the boat making him wish he had an extra hand to hold on by; or, again, button up Thomas Atkins in his great coat, put him on duty in a trench half full of snow on a dark night, freeze him hard enough, and then tell him to load his magazine arm and do the best he can with it.

These are but simple examples of circumstances under which the magazine arm may have to be used at any time by our soldiers and sailors, and therefore it is that I so heartily concur with Admiral Boys in a remark he made last year in this theatre, that for any magazine or quick-loader it is desirable that the cartridge should be issued in the contrivance to be employed. For this reason such guns as the Lee and Lee-Spencer, which have partly solved this difficulty, possess to some minds an advantage above other systems which involve an adherence to the old plan.

Bethel Burton has gone still further in this direction, and has to my mind produced a still more satisfactory solution of this question. But other inventions are in the field, and it is certain that no magazine arm can attain the highest excellence which does not in some way deal also with the question of cartridge carrying and cartridge packing, as well as that of a mechanical supply in the arm itself, and reliable contrivances for support, firing, and extraction.

You will observe that some of the inventions which I have mentioned relate to magazine arms proper, and others to weapons provided with an attachable magazine. It is right, I think, here to point out that what is called the attachable magazine is not one exclusively applied to existing arms, as is commonly supposed, by way of converting them into repeaters, but that when this is done it is only as a matter of convenience or economy, and, like all conversions, at best a compromise. The attachable magazine in its best form is used with a rifle constructed specially for it, which also forms an efficient single-loader when the magazine is detached.

The earliest, and by some even now considered the best weapon of this kind, is the Lee rifle, which has been for several years before the authorities in this country, the Lee magazine (Fig. 7) being also used in the Spencer-Lee rifle. Mannlicher places his diagonal magazine—an admirable invention—in the same position, and has constructed a special rifle to carry it as he has also done in the case of his diagonal overhead magazine.

In treating as I propose to do of the considerations which will probably guide us in the selection of a repeating arm, it will be

understood that when an attachable magazine is referred to it will be an attachable magazine, for which a special rifle will be required. Indeed, I think a useful distinction in our nomenclature might be made did we call such rifles as carry a detachable magazine, Magazine Guns, and those which contain their supply in the butt, Repeaters.

It is clear that each of these classes must have its peculiar advantages and also its drawbacks, and it may be useful to begin by considering them before dealing with other questions.

Indispensable as the magazine gun or the repeater will prove itself to be, and overwhelming as will be the advantages which it will confer on such troops as shall not only possess it, but be carefully and systematically trained to its use, we must not lose sight of the fact that, even in war, the occasions for their use will not be of everyday occurrence, though they may at any moment occur; furthermore, that troops will as a rule be able to foresee the need of them, so as to have time to fix their magazines in case they should require them, thus placing repeater and magazine guns in so far on a par with each other.

In time of peace or for ordinary duties, except practice, the magazine will never be required at all. That is to say, supposing that a soldier be so fortunate as to be campaigning during a twentieth part of his period of service, he will probably use his magazine only during a twentieth portion of that twentieth, or, roughly speaking, during the four-hundredth part of the time he carries a rifle, and for the 399 remaining portions of his time he must carry—or rather must he carry, clean, and keep in order, and must *we* pay for, a heavier, more delicate, more complicated, and more expensive gun than that at present in use, in order that at some period of his life he may successfully storm or defend a position, neither of which things could be done without it? As one proof of its necessity, it is hardly necessary to remind you that since I last dealt with this subject we have witnessed one of those brilliant operations of war the success or failure of which turned entirely on the question of the value of infantry fire as delivered from an intrenched position; that is to say, under exceptionally favourable conditions.

One hardly knows which to admire most, the daring of the conception or the profound calculation of comparative values which led to the night march on Tel-el-Kebir and the storm of that position with the bayonet.

I have heard the outburst of rifle fire from the works when the alarm was once given described as having been something awe-inspiring and terrible, and yet results showed that, as Lord Wolseley had calculated, it was practicable to push on in the face of it.

Can any one who has seen magazine arms used believe that success could have been gained in the teeth of such weapons had the Egyptians carried them and used them with coolness and determination?

I for one am unable to think so, nor do I believe that had the enemy been known to have been so armed, the attempt would ever have been made. Of course it is ill limiting the courage and dash of

British troops when led as they then were, but with all that, there are such things as physical impossibilities, one of which will be found to be the capture by an attack *en face* of any position which shall be adequately defended by troops armed with the repeating rifle; and yet such a defence may have to be made by any people, in any war, at any moment, and on its conduct may turn the issue of a battle, nay, even the fate of a nation.

It is clear, then, if this be so that, in some form or other, the repeater or the magazine-gun must form part of our armament, even though the average soldier will perhaps only need it during one four-hundredth part of his time.

This consideration would incline us at first sight to reject the repeater, and will probably decide some nations to do so.

On the other hand, we must not forget that it has many and great advantages over most forms of magazine-gun.

In the first place it is far more compact when any large number of cartridges are carried.

Then for passing through jungle and in many situations an attachable magazine, if an overhead one, would be almost impossible; as also would be the case for cavalry or mounted infantry in situations where the magazine would have to be kept fixed, and for such troops again a repeater would be preferable.

It is different when the magazine is placed on the side of the gun, but even this is not always convenient; besides which it must not be forgotten that any weight added to a rifle *unsymmetrically*, i.e., to one side and above or below the axis of the gun, will have a tendency to throw the bullet out of line, and were the weight to remain always the same would necessitate an alteration in the position of the zero point of the elevating sight; now as an attachable magazine never remains of the same weight for two consecutive shots, we thus introduce a variable source of error, and one for which it is impossible to compensate.

It is different when, as in the Lee, the Schulhof, and one form of the Mannlicher, the magazine is placed symmetrically and underneath the action of the gun. There the error is one of elevation alone, and is one which has been already partially compensated for in the original placing of the zero point. Mr. Bethel Burton on his part, however, has reduced any error possible from the position of his magazine to so narrow a margin, by his distribution of weights, as to make it practically, perhaps, hardly worth consideration.

I am, however, fully convinced that unless we shall adopt one of the systems or strike out for ourselves a system in which the packages in which our cartridges are carried can be placed entire in the reservoir or magazine of the weapon, and fired from thence in proper succession without more ado, our choice, whatever it may be, cannot be a final one.

Filling the magazine through a trap in the butt, or putting cartridges into the top of a box, one by one, is a process which needlessly wastes time, and as I have said before, one not at all adapted to all the exigencies of war, either by sea or land. In fact, we must

begin at the very beginning; the cartridges must be so packed as to be capable of being loaded *en bloc* into our gun as easily and quickly as a single cartridge is now pushed into such places as the Winchester tube, or the Lee magazine.

Once, however, we admit this principle we find, I think, our choice of systems narrowed down to a very small number indeed.

The Lee and Lee-Spencer guns, it is true, attempt a solution, but it is but an imperfect one, viz., the Lee magazine (Fig. 7). You cannot expect that any Government will consent to pack its rifle cartridges by fives in steel boxes of inconvenient shape which, in addition contain movable plates, and steel springs, studs and catches, and would neither stand sea air nor Indian magazines for a year, and remain serviceable, to say nothing of their first cost. Nor, I think, should we call on our soldiers or sailors to carry less cartridges and more useless metal than necessary, besides which we should not give them in addition to other things a lot of little boxes, which, in the heat of action, they must carefully put back in their pockets when empty.

The Mannlicher has, though in a less degree, the same disadvantage. The boxes take time to fill when once emptied; they are too expensive to admit of being thrown away, and none of them hold ten rounds.

The only rifles which are now in existence, and which have in any satisfactory way met this difficulty, are the Deeley Edge, which has a tin box with ten cartridges, but still contains a spring (Fig. 5, *b*), the Bethel Burton,¹ which does not (Fig. 8), and is in so far more satisfactory, both of which place their magazines on the side of the gun, and the Schulhof, which carries its box of cartridges in a trap in the stock (Fig. 2).

They say, indeed, that in this gun the wood of the stock is dangerously cut away, and far too liable to be split or damaged.

But why, may I ask, should there be such a thing as wood in the stock at all, to be cut away for this or for any other purpose, when stocks could be made so much better, stronger, and cheaper out of other materials, with all the necessary openings or hollows ready formed in them, instead of our having to cut down all the walnut-trees in Italy, and then by delicate and costly machinery form the timber into gun-stocks liable to split? Have we not to hand materials far more suitable which admit of being formed in a press to the requisite shape at a single blow? Metal, papier-maché, compressed wood, or half-a-dozen other substances might be treated in this way, but the necessary machinery could only be set up by the State, or by some large firm of manufacturers capable of bringing such a process to perfection, and willing to spend the time and the money necessary for the purpose; it is wholly out of the reach of any private individual.

Once done we should hear no more of want of room for our cartridges or of split or weakened stocks.

¹ The Bethel Burton magazine is placed partly beside and partly within the action of his rifle, and distributes the weight far better than any magazine on a similar plan; his bolt and general arrangement besides is admirable.

The stocks, too, would necessarily then be hollow, and the space thus gained could not possibly be better employed than by making a magazine of it, as Schulhof does.

Look at the outline of a gun, and the works which fill every part of it; here and here alone there is nothing but useless wood, and of course here the eye and common sense alike say should be your magazine, unless, indeed, you happen to prefer an excrescence as a matter of taste.

I have neither the time, nor had I that, the information that would be required, to give you a *résumé* of all that has been done in the way of the mechanism which more directly relates to the firing and extraction of the cartridges of these arms.

There seems to have been a very general abandonment, except in the case of the new Deeley Edge, of all systems but the bolt, and a tendency to simplify and improve the bolt, while making it secure against any possible risk of premature explosion.

Of bolt-guns, moreover, perhaps the Lee, Mannlicher, and the Bethel Burton are, as single-loaders, the most simple and efficient, and best adapted for use with the magazine. Should a compound or cross-bred gun be adopted, one of these three bolt-guns would probably be found suitable enough.

For carrying the cartridges we must remember that, however we make our package, it must be adapted for use with the single-loader as well as with the magazine; and for the machine-gun, in a less degree, as well as with either, and that it should be for these purposes of metal and not of paper or cardboard.

I have myself given some attention to this question, and this is the result (see Plate, Fig. 6); perhaps only an attempt at a solution, but at all events an attempt.

This is another, and far more elaborate one—the production of my friend M. Pieper, of Liège—which, as you see, might be fed into a gun of the simplest construction, and do away with magazines altogether (Fig. 9).

This is Mr. Burton's box; and, indeed, there are a dozen other ways of doing the same thing, *i.e.*, dividing the magazine-gun problem into two parts—the cartridge package and the magazine proper—and making the two work together harmoniously and simply in the gun.

On the correct solution of this question turns the entire future of magazine arms.¹ I can only hope that in saying so I am not on the one hand guilty of presumption, or on the other of contempt of court in thus treating of a subject still *sub judice* in every country in Europe.

Before concluding, I will, if you will permit me, show you what is as yet but an infant but still a well-grown and capable infant, and one that may well develop into a powerful and formidable man; and this is the electric gun of M. Pieper, of Liège. The details by which the current is produced or conveyed to the cartridge may be modified, and

¹ I should not, however, omit to state that in my opinion no mechanism will prove satisfactory which does not permit the magazine to be emptied *conveniently and rapidly* without removing the rifle from the shoulder.—G. V. F.

the source of electricity be carried in the gun itself instead of on the person of the firer. But the cartridge (Fig. 10) it would, I think, be impossible to simplify or improve; and, once we admit such a thing as possible, see the advantages which we obtain.

First, we do away with all the appliances for delivering a central blow on the cartridge, and have all the space which they now occupy for our magazine or other means of loading. Then, having no fulminate in the cartridges, we can carry and arrange them how we please; and, igniting the powder in front, we are enabled to get higher velocities with lower charges—a great desideratum. In machine-guns such as the new Gatling of Mr. George Accles, which fires 104 rounds in 2·4 seconds, and now necessitates the compression and release of 14-lb. springs so many times in that period, imagine the saving of labour which would result from the adoption of a system which required only the making and breaking of electrical contacts instead, and the saving of wear and tear which would result. But, as I said before, the thing is still in its infancy, and for these and other purposes is yet awaiting development. M. Pieper is already manufacturing these arms in the form which you see, and so far they are perfectly satisfactory—one great advantage being their immunity from danger of accidental explosion when out of the shooter's hands.

Here, again, is another weapon, also of Belgian origin. The Fusil Nagant, which contains several valuable novelties in the side sight for long-range shooting—the method in which the fore-end is attached to the barrel so as not to effect its accuracy, the stud for the sword-bayonet, and the ramrod tube, &c. It is, as you see, a small bore of 40 diameter; and Captain Guillaumôt, in the “*Revue Militaire Belge*,” speaks most highly of its performances both as to range, accuracy, and all the qualities we demand from a first-class weapon.

Its chief feature is, however, its admirable breech-mechanism, which for strength, simplicity, and the ease with which it may be dismounted, stands far before that of any single-loader with which I am acquainted. So rapid is its action, that Captain Guillaumôt goes so far as to say that its adoption would enable his Government to dispense with any form of repeater.

Major FERGUSSON (Rifle Brigade): My lords and gentlemen, I hope an unmounted Major who has never seen active service will not be accused of presumption in joining in this discussion. We have heard a very interesting lecture, and I should like to address myself to one or two points referred to by Colonel Fosbery. I was very glad to hear him speak well of field firing. I have just returned from three years' service in South Australia, where I have been a sort of Brigade Major, Adjutant, and Musketry Instructor rolled into one, and we did a great deal of field firing, very much more than is attempted in the Army. I cannot help thinking any changes in the direction of more field firing will be very wise. We used to take ten men per company out at a time and practise them in field firing and so on, till the majority of the men in all the companies had had a turn at it. We practised them in firing at unknown distances, now doubling, now advancing in quick time, now retiring, and so on. With reference to the Morris tube, it seems to me that no provision has been made for an enemy coming to you or going from you. We have been shown diagrams of the enemy crossing the field of view, but I take

it in action, the enemy is generally either coming or going, and not crossing. I should like to know whether the tubes are used also in practice accustoming men to firing at an enemy advancing and retiring. Then, again, about the time of flight, Colonel Fosbery recommends that men should be instructed in allowing for the time of flight of the bullet. Well, think what remarkably intelligent men you would require for that sort of additional practice and instruction! Would there be time to teach men that sort of thing, and is it necessary? Those of us who are accustomed to shoot grouse and partridges driving do not know anything about the time of flight of the shot, but we know by practice how much to allow in front of the bird, and so it would be with rifles. If men only got enough practice at field firing and at moving objects, there would be no necessity for giving them instruction in times of flight. Colonel Fosbery mentioned the Boers, and he hazarded the opinion that the Boers were the only people who are better shots than ourselves. Well, I do not believe the Boers are all such marvellous shots. I believe that Majuba Hill was lost because the men forgot that they were firing down a steep hill. The company Officers I am afraid forgot to tell the men that they must put their sights as low as they could, and even then fire low. We were told that the men were found lying dead with their rifles sighted at 400 yards. Of course, if you are firing down a steep hill you cannot put your sight down low enough. If any of you have practised at birds firing down a precipice, you know you must fire a long way below the bird. I believe if the men had only been cautioned in firing at the Boers coming up the hill to put their sights as low as they could, Sir George Colley, whom I well knew—the unfailing friend, the distinguished scholar, the brave soldier—would not have been lost to the British Army. I quite agree that a slow aim is not always the best. It is a very good thing for a man to learn to take aim quickly, but I must say I think the danger is not too slow firing in action, but too rapid firing. I speak with great submission, not having had experience in the field, but I have always understood the great thing was to try and get the men to fire slow. In the peace manœuvres at Aldershot I always found after a brush with the enemy the young soldiers had used up all their cartridges, but the knowing old soldiers had a good many left. If we are to inculcate rapid firing as the great *desideratum*, I think we shall do a great deal of mischief. How are you going to carry cartridges enough? We have been shown some very ingenious and clever contrivances for carrying cartridges, but how about the weight and the transport of this ammunition? I think Colonel Fosbery is a little too hard on the present system of instruction, especially with the modifications which are now introduced. I do not believe the mischief is done at the rifle range, but it is done at field days. The men are not sufficiently kept in order, there is no fire discipline; the men are allowed to fire without adjusting sights and without aim. They very often do not know what the objects of the manœuvres are, and perhaps you can hardly wonder that they treat the whole thing as if it was more or less nonsense. If they were made to consider it a point of honour always to take aim at something and to adjust the sight for every shot, then it would become a mechanical matter, and when they come into active service in the field they would not forget these particular things. I cannot believe that a repeating rifle is an arm to put into the hands of the recruit. It may be a good arm for the Navy, or for defending a fort or a field work. Perhaps a few picked marksmen of the regiment may be entrusted with repeating rifles, but I do hope that nothing rash will be done in the way of arming the whole British Army with repeating rifles. The Germans are going in the opposite direction; they are trying to simplify their arms as much as possible. I read the other day that an improved Mauser is being adopted in which the lock only consists of three pieces, very much less complicated than the old Mauser. That is the direction in which any changes in the British rifle ought to be made—to simplify the rifle as much as you can—because you must remember that your material is very raw, and even your old soldiers are uncommonly young men.

The EARL of WEMYSS: I regret very much that I have to go to another place to vote on a rather important question very soon, and therefore if you will allow me I will ask Sir Beauchamp Walker to take the chair in my place. Before doing so I should like to express my own thanks to Colonel Fosbery for the

very interesting lecture which he has given us. The last speaker thinks it is desirable to simplify the Martini-Henry, and not to have a magazine or repeater. Now I, for my part, am inclined to think that the feeling is growing that it is necessary to have something more than the ordinary rifle, and no further proof need be asked than the fact stated by Colonel Fosbery that every other nation in the world at the present moment is considering this question. I hear for instance that the Germans have ordered one thousand repeaters, and I am glad to see by the "Times" of this morning that Mr. Brand, who has charge of these things for the Government, announced last night that they were going to take a vote for a thousand in order to test this experimentally. I think there may be occasions when troops armed with the ordinary breech-loader opposed to troops armed with the magazine or repeater would be simply in the position in which the old muzzle-loader was when opposed to the breech-loader. I think that is indisputable, and there may be occasions when it would be necessary that they should fire very rapidly. As to the question what form it should take I think the ammunition ought to be self-contained with a view to simplification, for if not the magazine may not be to hand at the time that it is wanted. It seems to me to make all the difference whether it is self-contained, and that the repeater if you can get a good simple one without complication is the right way of having a rapidly firing arm. The Schulhof rifle seems to be as nearly perfect as possible. It opens in the stock: there is no spring in the mechanism, and the cartridges are all carried in a carton case which can afterwards be thrown away, and of which the man can carry two or three with the greatest convenience by the help of which the repeater can be loaded with great rapidity. This rifle when brought to my notice last year seemed so good and so simple that I ventured to write to Mr. Childers about it, calling his attention to what appeared to me to be a very simple and effective arm. I have seen nothing myself that appears preferable, and I am glad to find that Colonel Fosbery, having gone into the matter so thoroughly, seems to think that it is one well deserving the attention of this very appreciative audience. As regards field firing, there is no doubt that a man ought to be able to shoot in every possible way, in any position, and at every sort of object, but I own myself, having had a great deal of experience as a sportsman in the Highlands, in firing at things moving, judging distances and so forth, I should not have thought it possible that you could get every soldier in the Army to be trained up to what a deerstalker, after much experience, finds it very difficult to do, to be able to judge distances to shoot with any degree of accuracy at men moving across or in any direction even at 100 or 300 yards. My own conviction is this, that skirmishing in small sections under a section leader, that section leader being a thoroughly competent manstalker, is the only sound and practical system, and the one which will be found to give the most effective force in the field. If you had your men firing by word of command under the section leaders, I cannot help thinking in that respect you might possibly improve upon the general system, though you might not make every soldier in a regiment 600 strong a manstalker. I have only to add I have no doubt that the electric gun has a great future before it, that it is an infant Hercules in very small compass; but I think, seeing that Colonel Fosbery had to attach to his person a lightning conductor, and, seeing how possible it is in scrambling through brambles and woods that your conductor might get out of place, people will be very cautious before they adopt these infants! It may very likely succeed in the future, but it would be very awkward if, instead of hitting the object you aimed at, you found yourself unexpectedly blown up.

Colonel Sir LUMLEY GRAHAM: I had the pleasure of hearing Colonel Fosbery's lecture last year, a most interesting and instructive one, in which he gave us a very complete account of all the magazine arms and repeating arms then projected, and he has added to our information by his lecture to-day. I may remark perhaps, before saying anything further, that it has come to my knowledge that the Austrian *gendarmes* and the Tyrolese mounted rifles are armed with a repeater, which they call the Frukwrith. I have no particulars about it, except that it fires eight shots, but as the Austrian Government has armed its *gendarmes* and its Tyrolese riflemen with it, I suppose it is reckoned of some value. I wish to make some few remarks upon the first part of the subject—the general question—more the tactical question

than the technical question. I fully concur with all that Colonel Fosbery said about the necessity of extending our system of musketry instruction, and this happily our authorities have already determined to do. They have given a large extra allowance of ammunition, and they are also going to extend very much the system of field firing, which is a most important thing: for, as Colonel Fosbery remarked, hitherto, though we have had a very careful course of target practice, we can only look upon that as the preliminary instruction, just as the goose-step is the preliminary instruction for manœuvring. We have not got beyond the goose-step in firing as yet; I believe we have done our goose-step better than any other nation, but unfortunately we have stopped short there, while other nations have been going on to more practical work. Now we have seen the error of our ways, and we are going to embark in earnest in this system of field firing, which was introduced two or three years ago, but in a very mild form. There is one great difficulty connected with that—the difficulty about ranges, for unless you can get good and proper ranges you cannot have proper field-firing. With regard to the Morris tube, no doubt that, or some other thing of the same sort, is a most excellent part of the preliminary training of our soldiers; it will add very much to the interest of the thing, and no doubt conduce to make them better target-shots than now. I think Major Fergusson did not quite understand the Morris tube. It is not applicable to field firing at moving objects—at any rate it has not been hitherto applied to that—but it is meant to be used in the barrack-rooms or the barrack-square or quarters, as it is used in the German and other armies. Then, with regard to firing at moving objects, as Major Fergusson said, there is one thing that is forgotten, I believe, by all nations. I do not think in any system of musketry instruction the practice is carried out of firing at an advancing or receding enemy; yet that might be arranged by mechanical means. It seems to be a very important thing, particularly firing at an advancing enemy, because you are much more apt to miss a man coming at you than a man going away from you, and practice at an advancing object would lead to the aiming low which is always so important. I think Colonel Fosbery hardly did justice to those German authorities to whom he alluded, for he seemed to think that they considered aimed fire a matter of no importance. I do not gather that from what I have read and heard. I have read a good many of their books and have heard them talk a good deal upon this subject. I believe their feeling to be that great amount of fire in battle is of more importance than actual individual skill, and that fire discipline, in other words, the control the Officers have over the fire of the men, is perhaps of more importance than anything else, at the same time they do not undervalue skill in shooting. I do not think that it is their aim to make all their men good shots, even snap-shots. I think they go on the opposite principle. They do not waste time upon trying to make every man a good shot, what they aim at is to make all men fair shots at short and moderate ranges, and above all to make the collective shooting excellent—the volley-firing and that sort of thing. It seems to me that long-range individual firing cannot have great effect when we think of the many impediments to good shooting. First of all, there are the defects of vision. Dr. Forbes gave us a lecture¹ last year on the effect of sight on shooting, and it was perfectly appalling to hear his account: there seems to be hardly such a thing as a thoroughly sound eye. He mentioned no end of different defects, which most of us are unaware of. Shortsighted people, like myself, are perfectly well aware of the fact, but, according to him, the great majority of people, who are not aware that they have anything the matter with their eyes, have defects of vision, which must interfere more or less with accurate shooting. Then come the defects of the arm. The best made firearm we have is not thoroughly accurate at long ranges. Think again of the physical and moral disturbing effects of battle, and how all these things combined must affect accurate shooting. It appears, therefore, to me that the Germans are quite right in what I believe to be their views—that long-range individual firing is, as a general rule, thrown away—that long-range firing should be confined to volleys, and the individual firing should be kept for the shorter ranges, where it is likely to be effective. I have been reading a good deal lately about the Lee rifle, and I came here with the idea that the Lee arrangement was the best of

¹ See Journal, vol. xxvi, No. CXVIII.

all. I thought certainly from all that I had heard of the magazine and repeating arms that it was necessary that the cartridges should be put together *en bloc* into the magazine, for it is evident that neither soldier nor sailor would be able in the heat of action to refill his magazine with separate cartridges. Therefore I came to the conclusion that it was absolutely necessary that the soldier should be furnished with cartridge-cases, each of which should contain enough to fill the magazine, an arrangement provided for by Mr. Lee. I was reading a little book, lately published in Germany, called "The Arm of the Present and the Future," in which, after describing all the different arms, the writer gives the preference to that Lee arrangement; but he says at the same time that there are two great defects in it: first of all, the small number of cartridges which it holds, and secondly, the weight of its magazine. However, my preference for the Lee rifle departed when I saw to-day the arrangement that Colonel Fosbery has shown us in the Schulhof rifle; that seemed to me the best possible, always supposing that the interior machinery works correctly, for it must be an immense gain to have everything within the gun and nothing exterior to it. The weight of the ammunition is no doubt a very important thing, and if we are to use magazine arms effectively, we must expect to expend more ammunition than we have hitherto used. The Germans tell us that improvements in firearms lead to diminished expenditure of ammunition, mentioning as an instance that when they introduced the breech-loading rifle in the campaign of 1866 they used less ammunition in proportion per man than had ever been expended in any previous campaign. That may apply to the whole army, but not to the particular individuals hotly engaged, for I know that in the war of 1870 there were several instances of whole regiments that had fired away all their ammunition, though the total expenditure throughout the army was not large. We must, I think, provide for supplying a very large extra amount of ammunition, and though our soldiers now carry eighty rounds, they will have to carry a great deal more in future. The writer of this book, to which I have referred, tries to provide for the extra weight of ammunition in a rather extraordinary way. He is in favour of returning to the old system of paper cartridges. He says, "The present metal cartridge is very heavy; it adds considerably to the weight of the ammunition and causes damage to the powder." I believe all foreign armies use the solid metal cartridge, which lasts a very long time, and this writer thinks that when the powder is kept in these metal things for any length of time some chemical action sets in and the powder is damaged, and that this is the reason why there are frequently a great number of defective cartridges. Then, again, there is the defect of extra weight, so that altogether he is in favour of reintroducing the paper cartridge.

MR. NORDENFELT: There are only one or two points I wish to mention. The lecturer mentions that the greatest use, perhaps, of the magazine rifle would be in the case of repelling the attack of a storming party or at sea. No doubt, at sea the repeating rifle would be very useful indeed; but at sea it is exceedingly difficult to judge distance. When ashore, the storming party attacks you and comes well within 400 or 500 yards; it makes a rush; the soldier has his sight up after the previous firing from 500 yards, and I suppose, in a great proportion of cases, he will not recollect to put down his sight. I therefore think it absolutely necessary for a magazine rifle to be able to fire at 400, 500, or even 600 yards, without raising the sight. It can be done, and it has been done. The Small Arms Factory at Enfield have lately made exceedingly good rifles for such purposes, and other people as well; but unless something of that kind is done, I do not see the use of firing very rapidly for a couple of minutes if your shot are going far over the heads of the enemy. At sea this is still more important, because there the distances are constantly varying, and, unless you have an extremely flat trajectory, I am afraid the magazine rifle shots would be thrown away. Then, as to practice in field firing: to fire against moving objects has never seemed to me of so much use as firing against small targets. I gave a prize last year to a London corps, to which I have the honour to belong, for firing under the following circumstances:—The shoulders and head of a man to be taken for the target, and each company to send out one squad of their best shots; to double over 300 to 400 yards; to stop three times, and have two minutes given to fire at this head and shoulders, and then the hits to be counted. It was certainly wonderful, with some of the best shots in the country, to see how

few could make good scores within 400 yards under these circumstances—and why? Because the men were pumped, and because they, not knowing the distances, missed. They missed more especially in elevation than in lateral direction. If you have a repeater or a magazine rifle which does not require the sight to be raised within 500 yards a much better target would have been made: and there is very little difficulty in doing that, because if you make it fire “point blank” at 300 yards, the trajectory being low, you could aim beyond that at the man’s head, and probably you would hit him in the body.

Admiral SELWYN: I wish to say how very much pleased I am to find the progress made since we listened to Colonel Fosbery last year. First of all, we must congratulate ourselves on the fact that an attempt is being made to settle, once for all, the calibre and proportions of lead and powder, and the material and shape of the cartridge; and on that subject I think I may say that those who began this question of breech-loading tried every kind of thing before they took to the metal cartridge. Paper in all forms was tried, either simply combustible or impregnated in such a way as to form a part of the explosive force. Then skin cartridges, collodion cartridges, in fact, every possible device was resorted to, but there was found a fatal defect in all breech-loaders—the gas spit—and we never did get rid of that until we took to a solid-drawn metal cartridge. Now to go back on anybody’s leading or showing on account of presumed weight of cartridge would be to make a step to the rear. The true metallic cartridge properly made does not weigh more than a paper cartridge, which would be efficient. The paper cartridge must have a metallic base, unless it is not to be withdrawn at all, but is to contribute to the combustion in some way; but even allowing that to be the case, there would still be found a fouling which is now taken up by the cartridge-case, and which would then remain in the chamber, and would be a serious and almost a fatal objection. With regard to the calibre and form of the cartridge-case, I hope the decision has not been, or will not be, taken with regard to the infantry weapon alone, but also with a due consideration of what is necessary for the machine-gun. I presume the infantry question must govern the whole—that the machine-gun is only regarded as an auxiliary to the infantry, and that it must to a certain extent subordinate itself to the question of weight to be carried by the infantry, since it is quite clear that while we can easily devote more horse-power to carry a greater number of cartridges for the machine-gun, we cannot increase very materially the weights carried by the soldier. And in this connection I am very pleased to observe a theory which has long been talked of in this Institution—the useless weight of the stock turned into useful weight of cartridges. If I were grouping guns together, breech-loaders, magazine, or repeaters, I should put in the first class those which economized useless weight. I should say we must not add one ounce of useless weight to the gun; all added weight must be strictly confined to the cartridge; every ounce of weight in the gun that is not absolutely necessary must be suppressed; and Colonel Fosbery has touched the point very ably in pointing out that the stock of the gun is one of the most senseless things ever made—4 lbs. of solid wood, equal to 40 cartridges. I am quite sure in America they would long ago have given it up, had not somebody suggested that the great use of the rifle was to knock down your enemy, and consequently you require a club as well as a rifle. I think my prejudice in favour of the Winchester does give way to a certain extent to the Schulhof. I believe that the Schulhof is a very good gun indeed. The one thing I should wish to see changed in it is that bolt operation which sticks out into the palm of the hand. We heard a great deal during the Franco-Prussian War about the effect of that bolt in utterly destroying the steadiness of the man’s hand, and sending a tremor up into his arm which rapidly disqualified him for firing with accuracy. It is a fact that the muscles of the hand are specially liable to that kind of tremor which ends in lock-jaw. They are not intended to be so struck; and any man who has used a chisel and mallet knows the difference between using the hand on the chisel and resorting to his mallet. I should like, therefore, to see in that gun a certain form of lever operating the bolt; it is much less objectionable, much less liable to catch, and it would be a very great improvement if that were added to the Schulhof. With regard to the question of shifting or varying weights, I must say that when we come to consider what

is the use of a magazine or repeating gun, when we expect to use the magazine, and how we expect to use it, it does seem to me that the question of weights and the distribution of weights has been very much overrated. I do not expect we shall ever fire with the magazine unless we have an opportunity of kneeling or lying down, or of getting into a very steady position; for it would be madness to throw away the magazine fire in any other way, unless it were a very close volley at a large body of men. Under these circumstances, we shall always have some sort of rest for our rifles; and though I recognize the fact that, having put the cartridges into the butt, it must have sometimes a varying weight, and yet that will not materially influence the aim at any time when the troops are likely to be using the magazine; and, certainly, as the weight of the cartridges inserted does not very much exceed the weight of the wood which is cut away, it simply comes on all ordinary occasions to the same thing. Therefore we have got back our rifle with a lot of useless weight disposed of, and a good deal of useful weight put in. I would suggest whether there is any great use in having a piece of wood to reinforce the piece of steel in front under the barrel, or whether we may not surrender our piece of wood and have something lighter and very much stronger. If it is for the purpose of keeping the hand of the soldier off the hot or cold metal, then I should say we might manage that with a little vulcanite very much more satisfactorily. I hope to see the day when the leaders in these matters will say, "Well now, we have surrendered all our prejudices. Give us the best thing you can, and we will consider it in all its lights, and give due weight to everything that improves our existing infantry arm, while not attaching undue importance to long-range and not forgetting that bullets to be effective must stop a cavalry charge as well as send men to the hospital to die some days after being perforated by an express bullet of small calibre."

Captain McEvoy: In looking into the subject some years ago, I came to the conclusion that there was no safe way of employing electricity in connection with small-arms. I noticed that the cartridge fired to-day by our lecturer was fired by a low-tension current, and this involves the use of a piece of platinum wire. That is too expensive an arrangement, and unless the cartridges can be fired by a high-tension current, by a spark, I cannot for one moment imagine that the invention will present any feature of economy such as to make it generally applicable. Then if a high-tension current is employed there is very great danger of failure, or premature firing, as that character of electricity has a tendency to firing in the direction of any metallic attraction. I would therefore discard it as not being practicable. I was very much interested to see the success of that experiment, but I have no hesitation in saying if electricity is to be employed in small-arms, all that paraphernalia of insulation must be discarded, something simpler must be employed, and the great feature of safety must be looked to; when that is done we may have an electrical firing gun that will be available. At present it is in the stage of a toy, it is very taking, but it wants a good deal more to be done to it. With regard to Colonel Fosbery's remarks as to the value of magazine-guns, I fully agree with him as to the great future they have before them, and I cannot see how fast-firing guns can be ignored, as they must be an important feature in all Services in the future. I firmly believe that magazine, or repeating guns, when brought into action in an emergency, will be looked upon in the light of a timely reinforcement.

Captain LUMLEY (late German Cavalry): As I have given a great deal of my attention to repeating rifles, and have seen a good deal of what has been going on here and abroad, and have also conversed with many German and French Officers of great experience upon the subject, I may say that they have all but one opinion with reference to the necessity of adopting a repeating arm, but that this entirely depends on anybody else adopting one, for so long as no nation adopts one, there would be no necessity to do so, while on the other hand, as soon as one nation adopts it, every other nation must follow its example. With regard to the expenditure of ammunition, men who are a great deal more competent to give an opinion than myself say it is a fallacy to believe that repeating rifles require more ammunition, because there are only certain moments when the repeating rifle would be used; and I must say I do not agree with Mr. Nordenfelt and others who say that it should be

used at long distances. A repeating rifle should solely be used at close quarters to repel an assault or to prepare an assault, and to repulse an attack of cavalry when the cavalry is bearing down upon you. For we shall see in the next great war that takes place that cavalry will play a great part, and then infantry armed with a repeating rifle will be able to bring it to bear advantageously against a very formidable enemy. The disadvantages of most repeating rifles are that you have always to carry them loaded; therefore what we want is a repeating rifle that can be loaded when it is wanted, a rifle that can be used as a single-loader, and at the word of command can be loaded and used as a repeater. Using it as a single-loader you will only expend the same amount of ammunition as with a non-repeating rifle, and as you should only use your repeating mechanism at the decisive moment, and this moment having passed you will not be in want of ammunition or will have plenty of time to obtain it. Therefore the objection as to waste of ammunition does not lie with the rifle at all, but with the Officers who control the men, in their being able to make the men do as they are taught. Taking all in all the necessity of adopting a repeating rifle comes to this, that if other nations adopt it we must adopt it also. It has been said that if the cartridges are placed in the butt we weaken the stock and could not use it as a club, if this is an objection, what then becomes of our wonderful bayonet? for we do not want the bayonet if we are to use the butt of a rifle as a club; so if we prefer to use a club, we are carrying about a useless amount of weight in the shape of the bayonet.

Admiral BOYS: I only rise because Colonel Fosbery has referred to a remark I made last year in this theatre, that for any magazine arm or quick-loader it is desirable the cartridges should be issued in the contrivance to be employed. I am glad to see that he entirely concurs, as I am sure it is the right view. I concur in the distinction he makes between the magazine-gun and the repeater, and for the general requirements of the Service I prefer the magazine rifle. It will make not the slightest difference to the Services how the ammunition is packed as long as it is properly protected and preserved from damp, and can be readily got at. For the Navy the cases when a magazine rifle will be most required will be at the last supreme moment, when ships pass close to each other rapidly. When Captain McEvoy and gentlemen of his calibre send torpedoes in fast boats alongside of our ships, then is the moment that we want an extremely rapid fire. Mr. Nordenfelt objects to magazine arms on account of the complication of altering the sights for varying distances; my view is that when you have to raise your sight at all you do not want a magazine rifle, you only require it when there is no occasion to raise the sight, when you simply have to point a fire rapidly. In boat actions, I think, when two boats are grappling together, then is just the time when five or six very rapidly fired projectiles would have an immense effect, when you could not possibly miss. I would not propose to use a magazine rifle except at close quarters, more especially from boats. With regard to the question of the cartridges I am sure that whatever is decided upon for the small-arm of the Services, if we give Mr. Nordenfelt and Mr. Hotchkiss (who I see is present) a pattern of the cartridge, and adhere strictly to it, they will have no difficulty in adapting their machine-guns to use it.

Colonel ARBUTHNOT, R.A.: I am not going to say which arm I consider the best, for two reasons. In the first place as I see so many inventors present at this lecture, I do not wish to run the risk of treading on any one's toes; and in the second place, as I am on the Committee for deciding this question, it is not for me to say what the Committee think with regard to the business which has been laid before them. But this much I can say, that not a single magazine arm has come before the Committee up to this present time that does not possess so many disadvantages that there is not one which we should recommend for adoption in the Service in its present condition. I do not at all despair of arriving at a satisfactory arm which shall be suitable for the Navy as well as for the Army, but I think very likely it will end by part of one being taken and part of another, as Colonel Fosbery said in his lecture. I may say it is not the easy matter which many people think it is, and the best proof of that is, that there is not a single nation as yet that has got a magazine arm with which they are satisfied, and when we see that neither the Americans nor the Germans are satisfied with an arm I think we may rest assured that there are

difficulties in the way which are not easily overcome. With regard to the barrel and ammunition, I may say that at Enfield experiments have been carried on for the last two years in trying to get a good barrel and cartridge, and I think we have arrived at a barrel that will meet all requirements, and therefore the time has not been thrown away, because whatever magazine or breech action is eventually adopted, any barrel can be fitted to it. The barrel and breech action magazines are two distinct questions, and as soon as the magazine is settled upon, the barrel will be fitted to it. That barrel has a smaller bore than the present Service barrel; the ammunition is lighter, has a higher velocity at all ranges than any known existing military arm and a lower trajectory. The cartridge is so constructed as to be fitted to the present rifle-bore machine-guns, but it is the same length as the present Gatling, and therefore, when it is adopted, the only alteration which will be required in the existing machine-guns will be to change the barrels. You will then have a machine-gun firing a cartridge superior to any military cartridge at present in the world, as far as its properties are concerned. It is a solid metal cartridge, which I think will meet Admiral Selwyn's views of what a cartridge ought to be, and has given very good results in other ways.

Major-General GORDON: Colonel Arbuthnot's explanations and remarks have anticipated what I had principally to say on the subject of repeating rifles. I may add that the object of the much-abused wooden stock seems to have been lost sight of. I do not think any other material has as yet been proposed that will give the necessary strength and elasticity; any rigid substance touching the barrel would interfere with accuracy. With regard to field firing, I have seen much of it in India, and from what has been said this afternoon, I do not think the main object of its introduction is generally realized. Practice by squads of ten or twelve on a range or on known ground in no way meets the desired purpose. Its intention is to habituate the men to firing in the greatest available masses, as on service, and to enable the Officers and men to see the effect of such fire upon figures and screens which are entrenched, and only placed in such ground as an enemy would occupy. Many advantages have followed this method of carrying out field firing, amongst them, the searching consequence of long-range fire on screens, placed, often out of sight of the firers, in covered positions such as would be occupied by the supports and reserves of an enemy. It was found that this disturbing effect was the result of firing at the longer ranges. The trajectory of the bullets which miss and pass over an advanced trench on the crest of a hill or undulation follows their reverse slopes, and thus makes it necessary that the distances at which such firing should be prosecuted must depend on the nature of the slopes of the ground behind which the reserves may be posted. I entirely agree with the Officer who argued that long-range firing should be carried out by masses firing section volleys. It should be the object of the Officers to carefully choose suitable positions from which this could be efficiently done. The individual firing of a few picked men, at such long ranges, is not the question, because such a feeble fire could never have the spread which alone would disturb an enemy; for this, the present rifle is perfectly efficient. The rapid fire of magazine-guns can only be required at the shorter distances, and if so used at the proper time, their effect must be very great.

Colonel FOSBERY: I have but few words to say in reply. I really cannot follow Major Fergusson back to the beginning of his argument where he disputes the broad principles on which rests the question of the introduction or rejection of magazine arms. It appears to me that we have long passed all that. Again, as for the men losing interest in field shooting—aiming at nothing, and so throwing away all the benefit they may have derived from their target practices and previous training—all that I can say is that the fault must lie with their Officers when they do so. It is clearly the duty of the Officer to see that his men profit rather than lose by such exercises; and to keep up their interest in practices designed to represent, as far as may be, the actual circumstances of war. I think I ought to have explained to Sir Lumley Graham more clearly than I did that moving targets, designed to be used with the tube, have been devised. The tubes are not intended to be used in field firings but for practice at miniature targets which will instruct the men in the principles on which aim should be taken at moving objects in the field. As for firing at an advancing and retreating enemy, I do not very well see how

one could make targets which would really represent such motions with any degree of truth, or that any motion we could devise would have a corresponding effect.¹ The only thing I can remember to have been done in that way is in an experimental trial which took place at Enfield, when the men were moved gradually up to the target firing for twenty seconds at each halt. I know of no other plan unless, indeed, we could mount our running target on a railway train. I probably have misapprehended the real German view of mass fire. But at all events, I think it may fairly be said that they have given up in despair the idea of obtaining what I still hope to obtain, individual excellence in the fire of masses—not that they have lost sight of the value of the thing could it be got. The reason is probably this, that the German Musketry Instructor is always the Captain of his company. That is, the man gets all the technical instruction he ever gets out of his Captain, as we are proposing to do ourselves. Now, it requires something more than the average Captain of a company to give that class of instruction, to get the ordinary mind of the common soldier to apprehend certain necessary scientific truths, to get delicacy of perception and delicacy of touch out of heavy intellects and hard fingers. This was the duty of the old instructors of musketry, and a very difficult and troublesome duty it was; and I believe that the only thing that kept them up to it and enabled them to perform it as they did, was a certain sort of enthusiasm which earned for many of them the reputation of being mad on musketry subjects, at all events, a set of qualities not to be found in the ordinary Officers of companies, whose instruction can never possess the same qualities to the same extent. With regard to the Boers' shooting being so much inferior to what has been represented, I was talking only three or four days since to a distinguished Officer who commanded a large body of irregulars during the campaign, and had the best possible opportunities of judging; he told me that the Boers' shooting was simply marvellous, and that not only were individuals amongst them extraordinary shots, but that they were so as a people. He had himself seen them knock over antelope running at 500 and 600 yards, and these not picked men, but the average run of the people who did our troops so much mischief. I am glad to find so general an adhesion to my proposition for loading in the cartridges *en bloc*. It is only in this way, I feel convinced, that we shall get the best results from any repeater. As to the question of the weight of ammunition to be carried by the men, an American Officer lately told me that during the War of Secession he commanded a brigade in which one regiment was armed with repeaters, while the others carried the ordinary single-loader, and that the expenditure of ammunition with the repeater was not so great as that with the single-loader, or, at all events, that the single-loaders were out of ammunition five times to once with the repeaters; and I think the explanation is a very simple one. In the first place, the men got so much confidence in their repeaters that they would cheerfully carry as much ammunition as they could get; but, in the second place, they used that ammunition far more scientifically, and with far more deliberation, than did the others. It is not difficult to see what would happen with a repeater. Supposing you have an ordinary single-loader in your hands, and you see a man coming at you, say, at 100 yards, you naturally make some such calculation as this, "I will have a shot at him now, and a second shot when he gets a bit nearer, but I must give myself time to get a third into my gun against he comes to close quarters." So you fire at once at him at the 100 yards, and firing in a hurry probably miss him. You may or may not miss him the second shot, and you may or may not have time to get in your third shot, and kill him at close quarters before he can kill you; but even should you do so you will have wasted two rounds of ball cartridge. But with

¹ Since I made the above remarks a moving target has been designed for the aiming tube which will answer every purpose—the object aimed at being made to approach or recede from the target on which the hits are recorded in a vertical line, and at a speed capable of regulation—thus to keep on the target the sights will have to be continually raised or lowered during the practice, as would be the case when firing at a retreating or advancing enemy—the apparatus being regulated to any speed considered desirable for the purposes of instruction.—G. V. F.

the magazine-gun you reflect that there need be no such hurry about the matter. No time practically is required for loading, and you can wait till he gets within the length of the room and have your three shots at him all the same ; waiting quietly you probably knock him over with the first, and the two rounds are saved. Some such process as this is quite conceivable, and would fully account for the economy of ammunition. I think, considering the way in which I introduced the electrical gun to your notice, I need hardly discuss what Captain McEvoy has said on that subject. But I cannot conclude without thanking those who have taken part in this discussion for the kind way in which they have noticed the salient points of a very imperfect paper.

Sir BEAUCHAMP WALKER : I think at this very late hour of the evening I shall best meet the wishes of all present by omitting any remarks of my own, and by begging you to empower me to return a vote of thanks to Colonel Fosbery for his valuable lecture, and to add the thanks of those who have not spoken to those who have for assisting in carrying out the discussion on this very interesting subject.

NAMES OF MEMBERS who joined the Institution between the 1st October and 31st December, 1883.

LIFE MEMBERS.

Gordon, L. A. C., Lieut. R.A.	Williams, W. B., Capt. Wilts Regt.
Bates, H. S., Major 3rd Battn. Yorkshire Regiment.	Askwith, C. W., Lieut. R.N.
Kelly, A. J., Lieut. R.E.	Clarke, J. S., Lieut. R.N.
Goff, G. L. J., Lieut. Argyll and Sutherland Highlanders.	Primrose, Hon. Everard H., Col. Gren. Guards.
Fleming, E. W., Lieut. R.H.A.	Parkin, T., Esq., M.A., F.R.G.S., late Lieut. Royal Cumberland Militia.
Churchill, M., Major Northampton Regt.	Allen, J. R. H., Lieut. R.A.
Eustace, J. B., Lieut. R.N.	

ANNUAL SUBSCRIBERS.

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Badham, R. L. S., Capt. London Irish Rifles.	Barthorp, A. H., Lieut. Northampton Regiment.
Knox, W. G., Major R.H.A.	Pamphlett, W. F., Assistant Engineer R.N.
Disney, T. R., Lieut.-Col. R.A.	Blewitt, A., Lieut. King's R.R.C.
Corbyn, H., Lieut. R.A.	Polhill-Turner, C. H., Lieut. 2nd Drag. Gds.
Glyn, J. P. C., Col. Rifle Brigade.	Roper, A. W., Lieut. R.E.
Norman, F. B., C.B., Col. Bengal Staff Corps.	Crutchley, W. C., Lieut. R.N.R.
Purvis, J. S., Lieut. R.E.	Noyes, A. W., Major W. Yorks. Regt.
Hozier, H. M., Capt. late 2nd Life Gds.	St. George, A. W., Capt. W. Yorks. Regt.
Skinner, M. W., Capt. R.E.	Vials, H. G., Lieut. W. Yorks. Regt.
Kentish, J., Major 14th Hussars.	Roberts, A. N., Lieut. W. Yorks. Regt.
Gawne, J. M., Lieut. Royal Lancashire Regiment.	Mathew, B., Col. R.E.
O'Meara, W. A. G., Lieut. R.E.	Prothero, A. W. E., Lieut. R.N.
Blackett, R. S., Esq., late 6th Drag. Gds.	Fullerton, A. G., Com. R.N.
Richards, P. T., Com. R.N.	Hughes, R. J., C.B., Major-General.
	Murray, A. P., Lieut. Gord. Highlndrs.

OCCASIONAL PAPERS.

This portion of the Number is reserved for Articles, either Original or Compiled, on Professional Subjects connected with Foreign Naval and Military matters; also for Notices of Professional Books, either Foreign or English.

It is requested that communications or books for review may be addressed to Colonel Lonsdale Hale, at the Royal United Service Institution, Whitehall Yard, London, S.W.

THE UTILIZATION OF RIFLE FIRE IN THE FIELD.

By Major C. K. BROOKE, 1st Batt. East Yorkshire Regt.

UNFORTUNATELY the study of the science of "Fire Tactics" has been so neglected in this country, and so little data has been collected, that it is necessary to appeal chiefly to the results of experiments carried out abroad for the facts on which to base a theory of how best to utilize the power of the rifle in the field.

This paper will therefore be based upon, and make free use of, the tables, deductions, and criticisms contained in a "Commentary on the German Musketry Instructions" which appeared in 1882 in the "Revue Militaire de l'Étranger."

The result of the experimental firing conducted near Dungeness in 1879-80 will also be made use of as far as practicable.

Firing in the field may be divided into two categories: Individual, and Collective; the former being the fire of individual men when left to their own initiative, the latter the fire of several men acting together under the orders of a superior.

The discussion of the subject divides itself naturally into two parts; and it is proposed in the first to deal with individual fire, and in the second with collective fire.

PART I.

INDIVIDUAL FIRE.

The questions which mainly concern the individual firing of men are:—

"a." The relation which exists at each distance between the size of the object aimed at, and the dimensions of the grouping of a series of shots at the same distance.

"b." The point to aim at.

"c." The employment of fixed sights.

"d." The limit of effective individual fire.

"a." *The Relation between the Objective and Shot Groups.*

The influences which act on rifle firing are so diverse that even when the same man with the same rifle fires a series of about 50 shots without committing the least error, and aiming steadily at the same spot, the bullets

striking a vertical target cover a surface more or less large ; this surface represents the vertical grouping of the shots of the series at this distance, and may be called a vertical shot group.

The combined trajectories of all these shots constitute their "gerbe," and this may be likened to a curved horizontal cone, having its apex at the muzzle of the rifle, and its base at the object aimed at.

Plate XXV, Fig. 1, extracted from the "German Musketry Regulations," represents this gerbe or sheaf of shots ; and $a_5 O_4 b_4$ its terminal vertical shot group.

The horizontal grouping of the shots of a series is obtained from the vertical shot group by calculating the distance each shot would travel before reaching the ground. Since the drop of a bullet which strikes the top of a six foot high target is known for every distance, the calculation of the drop of all other shots can be practically determined by simple proportion. For example, the drop of a bullet at 500 yards when fired from the Henry-Martini rifle is, from the Dungeness experiments, 64 feet in 6 feet ; consequently, if a shot struck the target 4 feet from the ground, its horizontal projection behind the target would be $\frac{6}{4} = \frac{64}{x}$, or the bullet would reach the ground $42\frac{1}{2}$ feet in rear of the target. Plate XXV, Fig. 2 (Ger. Mus. Regn.) graphically represents the horizontal grouping of a series of shots. It has been found by experiment that in these groups, the shots tend to form a sort of nucleus in the centre, and to be more scattered at the margin.

The vertical grouping of the shots from the Mauser rifle takes the form of a circle as far as 150 m. inclusive, and thence the shot groups assume an oval shape of which the longer axis is vertical. The axes of these ovals go on increasing as the distance becomes greater, and their dimensions also vary more or less in accordance with the accuracy of the shooting of each rifle.

The dimensions of the vertical shot groups of the Mauser rifle are shown in Table 1 ; in which will be seen the percentage of abnormal hits which are subtracted at each distance in Germany. The centre of the shot group is determined by the position of a point which has an equal number of shots above and below it ; and an equal number to the right and left of it. Plate XXV, Fig. 3 (G. M. I.) illustrates this. In France, it is not thought that this central point is determined by such a rudimentary method.

Before proceeding further it will be necessary to assume some dimensions for the objects which are most frequently fired at in the field : the following will be the data made use of in this paper ; and are, except the height of a standing man, the dimensions adopted in Germany :—

	m.	ft.	in.
Man standing	1.60	or 5	4
„ kneeling	1.10	„	3 8
„ lying down, but not under cover.....	0.45	„	1 6
„ lying down, and under cover	0.35	„	1 2
Breadth of a man (the vulnerable part).....	0.40	„	1 4
„ „ group of two men	0.80	„	2 8
„ „ „ three men.....	1.20	„	4 0
A cavalry soldier, riding at a rapid rate.....	2.00	„	6 8

The relation between the above dimensions and the areas shown in Table 1 must always be borne in mind ; for allowing that the sighting of a series of shots is correct, and that no mistake is made in aiming, still these shots will only strike the mark so long as their grouping and the objective have the same extent of surface. When a distance is reached at which a shot group has a larger surface than that of the objective, then many of the bullets, though well directed, will miss their mark ; the number of misses increasing in proportion as the area of the shot group exceeds that of the objective.

THE GERBE.

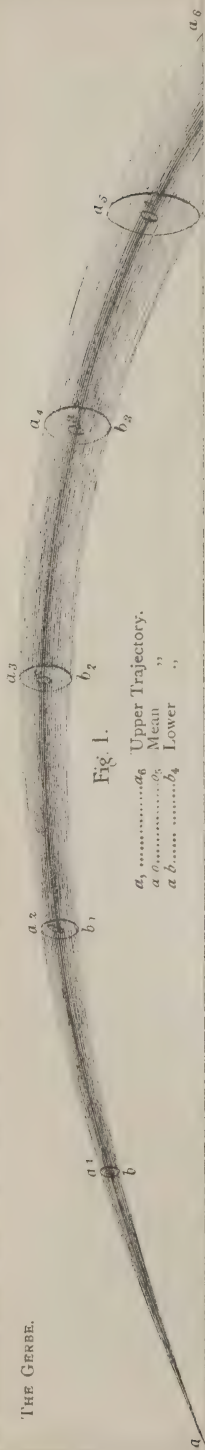


Fig. 1.

Upper Trajectory.
Mean
Lower

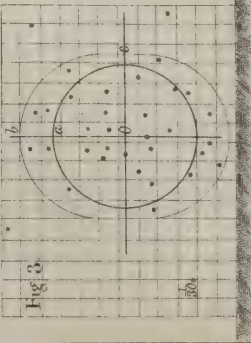


Fig. 3.

The vertical grouping of a series of shots.

- a a Radius of the circle enclosing the larger half of the hits.....
- a b Radius of the circle enclosing all vertical deviations.....
- a c Radius of the circle enclosing all horizontal deviations.....

Some abnormal hits not included.

Fig. 4.

A graphic representation of the combination of the gerbes of the 600 and 700 Metre Sights.



A F E The unshaded portion represents the hits on the imaginary screens (non. apart) of the series with the 600m. sight.
E F B The shaded portion represents the hits with the 700m. sight.
A B Dangerous ground.
C D Effective dangerous ground.
Targets between A and C, and between D and B, have less than 10 hits on them.
The Vertical Scale ($\frac{1}{100}$) is five times that of the Horizontal.

The horizontal grouping of a series of shots.
240 cm. Fig. 2.

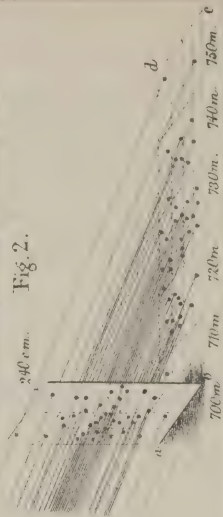
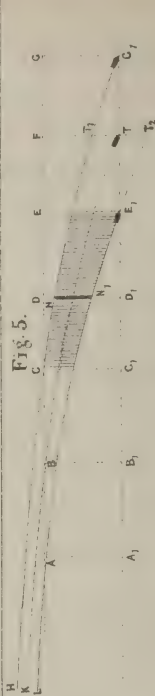


Fig. 5.



Space enclosed between the lines H C G₁ and L A E₁ = The gerbe.

- C C₁ = 1m 80 or 6 ft.
- H C G₁ = Upper trajectory of gerbe.
- L A E₁ = Lower " "
- K B T = Mean " "
- N N₁ = The nucleus; D B = D F = $\frac{1}{2}$ Dangerous zone.
- T₁ T₂ = Height of the shot group at the extremity of the range of the sight in use, aim being taken at the foot of the mark.

* The Diagram is a rough approximation of the 500m. gerbe with regard to its vertical representation. The horizontal measurements are considerably reduced.

For example, with correct sighting and accurate firing, it is necessary that the objective at 300 m. should be 48 cms. wide, and 58 cms. high, in order that 95 per cent. of the shots should strike it; if the object fired at had a less width or height, then a proportionably smaller number of hits would be made.

Passing on, the several trajectories which together define the shape of the "gerbe" must be glanced at. The mean trajectory of a rifle for any distance can be graphically traced by connecting the centres of a series of intermediate vertical shot groups, and is represented in Plate XXV, Fig. 1, by the line $a, O, \dots o_5$. The upper trajectory is traced by joining together the upper parts of these same shot groups; and the lower trajectory by joining all the lower parts of the groups: the line $a, a_1, \dots a_6$ shows the former, and the line $a, b, \dots b_4$ the latter.

The ordinates of the mean trajectory are the distances of the centre of the shot groups above the line of sight; the ordinates of the upper and the lower trajectories are obtained by adding to, or subtracting from the ordinates of the mean trajectory, half the vertical axes of the shot groups at the several distances.

For example, to find the ordinate of the upper trajectory of the 400 m. gerbe, at say 300 m.; add 29 cms., half the vertical axis of the shot group at 300 m., to 1.44 m., the ordinate of the 400 m. trajectory at the same distance, and their sum 1.73 m. is the ordinate required. Table 2 (G1, Ger. Mus. Inst.) shows the ordinates of the trajectories with the fixed sight of 270 m., the flap sight of 350 m., and the sight of 400 m.

If a gerbe be pictured mentally as a solid curved cone, lengthened by the elevation given to it, and having its terminal vertical area rapidly increased as it is directed on more and more distant objects; then the meaning of the term "shot groups" at various distances will become apparent, and they will be seen to be merely a series of vertical sections taken through the imaginary solid cone at the different distances. Looking thus at a gerbe, the conclusion arrived at from the foregoing investigation may be defined under the statement, that, in individual firing, the relation between an objective and a shot group is the relation that exists between their respective areas at the distance fired at.

"b." *The Point to aim at.*

The shot groups in individual firing have hitherto only been considered with reference to the object aimed at, when this has been at the same distance as that of the sight made use of: they must now, however, be considered with reference to an object which is at a less distance than that of the sight employed: there are two cases to examine.

(1.) When the aim is directed at the object.

(2.) When the aim is directed at an object whose distance from the firer corresponds with the sight made use of.

(1.) For example, in the first case let the aim be directed with the 350 m. sight at the foot of an object 300 m. from the firer; then if reference be made to Table 2 it will be seen that the centre of the shot group at this distance is 70 cms. (the ordinate of the 350 m. trajectory at 300 m.) above the line of sight, and as this is directed at the foot of the target, the centre of the shot group may be taken as 70 cms. above the ground.

But if under the same conditions the aim had been directed at the centre of the target (90 cms. above the ground) then the centre of the shot group would be $90 + 70$ cms. or 1 m. 60 cms. above the ground: and as the semi-diameter of the vertical axis of the shot group at 300 m., Table 1, is 29 cms., then the upper trajectory of the gerbe would pass 1 m. 60 cms. + 29 cms., or 9 cms. above the top of the target, and in consequence many shots would fail to hit:

whereas, if the aim had been directed at the foot of the target the whole of the shot group would have struck it.

The movement of the shot group is well shown in Table 3, in which the upper and lower trajectories of 350 m. gerbe are recorded as the aim is directed either at the foot or the centre of the targets placed at intervals of 50 m. from the firer. The trajectories are obtained as said before by adding to or subtracting from the ordinates of the mean trajectory the semi-diameters of the vertical axes contained in Table 1.

(2.) In the second case the position of the firer has to be taken into account, as the aim is directed at a mark beyond the object fired at. The heights of the different firing positions are in Germany laid down as under :—

Standing ....	....	....	....	1 m. 50 cms.
Kneeling ....	....	....	....	90 "
Lying down ....	....	....	....	30 "

It is evident, since the trajectory follows the line of sight, that if the latter be raised the ordinates of the former will be increased at all distances between the firing point and the object aimed at. Take for example the line of sight proceeding from a man standing to the centre of a target 1·80 m. high, and the line of sight directed by a man kneeling to the same place on the target : the former is a line falling from 1·50 m. to 90 cms., the latter is a horizontal line 90 cms. above the ground ; the firing position of a man kneeling and the centre of the target coinciding in height. Table 4 shows the height of the ordinates of these several lines of sight at different distances, under the conditions that the aim is either directed at the foot of the target, or at its centre.

To obtain the ordinates of the mean trajectory of 350 m. gerbe, it is only necessary to add to the ordinates of the line of sight in Table 4, the ordinates of the 350 m. trajectory as given in Table 2 ; the result is shown in Table 5. In order to further define the movements of the shot groups at intermediate distances, Tables 6 and 7 have been added ; they have been obtained respectively by adding to or subtracting from Table 4, the semi-diameters of the vertical axes contained in Table 1.

Using the above data, the position of the shot group on a target at 300 m. can be examined, when aim is taken with the 350 m. sight at another target at 350 m.

Let aim be first taken at the foot of the 350 m. target by a standing man ; then by Table 6, the upper trajectory of the shot group at 300 m. will be only 1·20 m. from the ground ; whereas, if the firer aimed at the centre of the target it would be 1·97 m. to 17 cms. off the target : again, if the firer kneels, and aims at the bottom of the target, the upper edge of the shot group will be 1·11 m. above the ground ; but if he aims at the centre of the target it will then be 1·89 m. from the ground, that is 9 cms. off the target.

Thus when firing either standing or kneeling, and aiming at the centre of the distant target, the upper part of the 350 m. gerbe passes above the 1·80 m. intermediate target, placed at 300 m. And the deduction may be made that when an object is 50 m. short of the mark aimed at, aim should be taken at the foot of this mark, both when firing standing or kneeling.

Before proceeding to consider generally how the 350 m. gerbe acts at all distances intermediate between the firer and 350 m., a glance at a battle-field must be taken. In a battle which is intended to be brought to an issue, one side must act on the offensive, the other on the defensive ; the rôles may be interchanged, but at any given moment the opposing front lines of the adversaries must be either advancing to the attack, or staying still to defend the position attacked ; therefore the distance between the two sides tends to diminish, and it becomes most important that the intervening space between the adversaries should be swept by a storm of bullets. The ideal of rifle fire

on the field is reached, when no bullet in the intervening space between the opponents passes over the head of a standing man: that is, does not rise higher than 1.60 m., or 5 feet 4 inches above the ground.

Other kinds of actions there are: demonstrative, and retreating; in the former a delaying fire is made use of, and time is given to work out distances; in the latter, the victors being safe, have to raise their sights as the enemy flies before them. But before the action is decided, when the strain is most intense and time most limited, then fingers must hold firmly the rifle which may at any moment be required for use in the way our forefathers handled it; they cannot be loosened to fiddle with a sight, or to adjust it to distances of 50 yards, nor can the eyes be lowered for the purpose, or taken off the enemy, when he is advancing on us, or we on him.

In discussing this question of rifle fire in the intervening space between closely opposing forces, tables based on the employment of the 350 m. sight will alone be made use of; for if they serve to prove that it is advantageous under the above circumstances to aim at a certain portion of the objective, then analogous tables based on the use of other sights are not needed as they would only tend to confirm the same fact.

If Table 5 be examined it will be seen, that when firing standing and aiming at the bottom of the target, the centre of the shot group will pass over the heads of standing men for 150 m., viz., from 50 m. to 200 m.: if aim is taken at the centre of the target, the centre of the shot group will clear a man for 250 m., viz., from 50 m. to 300 m. Again, Table 7 shows that when the firer is standing, and aim is taken at the bottom of the target, the lowest part of the gerbe passes over a standing man from 50 m. to 200 m., and if aim is taken at the centre of the target from 50 m. to 250 m. Table 6 shows that the upper part of the gerbe under similar conditions passes respectively over a man's head from 50 m. to 250 m., and from 50 m. to 300 m. Further, if a man is firing lying down and aim is taken at the middle of the target, the whole of the shot groups for 100 m., viz., from 150 m. to 250 m., pass over a man's head; whereas if aim is taken at the bottom of the target, the whole of all the shot groups strike a standing man.

From all these facts the deduction may be: that when aim is taken at the bottom of an object the intervening space swept by the gerbe is lengthened.

Another point in the question must be considered, viz., the effect of taking a fine or full sight. At 300 m., if the former is made use of, the mean trajectory is depressed 15 cms., and if the latter, it is raised a similar amount. Looking at Table 5, it will be seen that at 300 m. the use of the full sight will raise the centre of the 350 m. gerbe above the head of a standing man, when aim from the kneeling or lying down position has been directed at the centre of the target; whereas under similar conditions, if aim had been taken at the foot of the target the full sight would not have caused any shots to pass over a man's head. Hence the deduction may be made, that aiming at the foot of an object diminishes the evil resulting from the use of a full sight.

When a fine sight is employed in conjunction with aiming at the bottom of the target more ricochets are caused, and this brings into prominence an objection that might be raised to aim being always directed at the foot of an object, namely, that when the correct sighting is used only one-half of the shot group will directly strike the mark. The action of ricochets can be studied by the light thrown on them by the Dungeness experimental firing; in the report it is stated that "the bulk of ricochet hits is effective," and that the mean rise of a bullet is twice that of its drop. Having this data, the objection raised can be met, and the following example may serve as an illustration. Let aim be taken with the 350 m. sight at the foot of a target at 350 m., then by Table 7 the lower trajectory will theoretically pass 34 cms.

below the target, but the bullets will really strike the ground in front of the target. This distance may be obtained proportionally from Table 1, which shows that a bullet fired under the circumstances above stated falls 39 cms. in the last 25 m., consequently the bullets in question will strike the ground 18 m. from the target; since the rise is twice the drop, the bullets in ricocheting will strike the target 2×34 cms., or 68 cms. from the ground. It may be noticed that the height at which the shots of the lower trajectory ricochet into the target, always coincides with the vertical axis of the shot group at the distance fired at.

As the lower trajectory represents the path of the bottom bullet of a gerbe, it follows that in the case discussed all the bullets strike the target.

From Table 1 it will be seen that up to 600 m. the longer axis of a shot group does not exceed a man's height; consequently the deduction may be made that if aim is taken at the foot of a standing man he is liable to be struck by all the ricochets proceeding from the lower trajectories of the several gerbes up to 600 m.

Tactical reasons have been adduced in support of the principle of aiming at the foot of the object, and they have been stated as follows: "If the smoke hides the objective it is impossible to aim at its centre, while on the contrary it is very easy to distinguish and aim at a mark taken on the line of separation which exists between the cloud of smoke and the ground, this line being clearly defined in the field. On the other hand, if the adversary, while advancing, disappears behind some artificial shelter, or is lost to sight in a depression in the ground, aim can still be taken at the entrenchment, or at the mark on the ground previously selected, the bullets thus fired will have a good chance of being well directed. Besides, is not the soldier in the heat of action always tempted to take too full a sight? in making him aim at the bottom of the object a compensating influence is brought to bear on this fault, which is so common amongst men in the field." Further by thus aiming at the bottom of the objective the gerbe is lowered, and the enemy as he advances, plunges himself more deeply into the rain of bullets, instead of getting out of it, as he would, if aim had been taken in the centre of the object fired at.

To sum up, aim in individual firing should always be directed at the foot of the object for the following reasons:—

"a." That the intervening space swept by the gerbe is lengthened.

"b." That the evil arising from the use of a full sight is mitigated.

"c." That the ricochets of the lower half of all gerbes up to 600 m. are better utilized.

"d." That tactically it is advantageous.

"c." *The Employment of Fixed Sights.*

It has been shown that for tactical reasons soldiers cannot adjust their sights at the critical moment of the combat, either when they are advancing rapidly on the enemy or he on them. The maximum distance which separates the opposing sides at the commencement of this stage of an action, may be assumed to be about 400 yards (360 m.), therefore a fixed sight or fixed sights are required to sweep this space. The number of sights employed must be limited, one would be best, but two are the most that would fulfil the required conditions. In Germany two are made use of, viz., a 270 m. fixed sight, and a 350 m. easily raised flap sight. An examination of the action of these two sights will be sufficient to prove if the principle of the use of fixed sights is advantageous or not. Unfortunately the question cannot be discussed with reference to our own Martini-Henry rifle, as no accurate data is published, and it is very doubtful if the necessary long-continued experimental firing has ever been carried out.

To aid in the investigation, Tables 8-11 have been calculated in a similar

manner to Tables 4-7; and, in addition, the action of ricochets has been added to Tables 5-7, and embodied in Tables 9-11.

First with regard to the action of the 270 m. sight: if Tables 9-11 be examined it will be seen that the whole of the gerbe proceeding from men firing in the standing position, and aiming at the bottom of a target, will strike a standing man (5' 4" or 1.60 m.) throughout its course up to 270 m.; with the solitary exception that the bullets in its upper trajectory pass 2 inches above a man's breast at 190 m. If the action of ricochets is included, the same tables show that the ground swept by the gerbe may be extended to 300 m.; thus, practically, men firing standing and aiming at the foot of their objective, cover with their fire any standing man up to 300 m. Again, if the ordinates of the gerbe of men firing in the kneeling or lying down position be looked at, it will be seen how much closer the gerbe sweeps to the earth; and as few men in action would be firing otherwise when the enemy was within 300 m. of them, the efficiency of the gerbe is largely increased.

Another point must be taken into account, that is, when aim is taken at any object at a less distance than 270 m., the line of sight is proportionably depressed, and the gerbe in consequence passes closer to the ground.

From all the above it may safely be concluded that the use of the fixed 270 m. sight, combined with aiming low, enables all the ground in front of the firer to be swept up to 300 m.

To cover the remaining space, viz., up to 360 m. or 400 yards, the 350 m. sight will suffice; looking at Tables 5 to 7 it will be seen that with a standing man aiming at the foot of a target the upper trajectory of the 350 m. gerbe at 300 m. is only 1.20 m. above the ground; and that at 360 m., including the action of ricochets, no shots rise higher than 1.06 m.; again, the mean trajectory at 300 m. will strike a kneeling man, and at 360 m. its ricochets only rise 0.06 m. above a man lying down; hence with flap sight of 350 m. all the ground between 300 m., the limit of the action of the 270 m. sight, and 400 yards, is thoroughly swept; and the conclusion is arrived at that two sights, combined with aiming at the foot of the mark, are sufficient to keep all the ground up to 400 yards well under fire.

Incidentally it may be observed that the analysis of the action of these two sights affords a strong argument in favour of reducing the trajectory of the rifle, for if this were flattened one fixed sight would cover all the ground up to 400 yards.

"d." The Limit of Effective Individual Fire.

Individual fire has previously been defined as "the fire of individual men when left to their own initiative;" that is to say, it is the fire of skirmishers freed from all directions, therefore free to choose their object, their sight, and to regulate their own consumption of ammunition. Accepting this definition, it becomes necessary to fix some limits within which this fire may be employed, otherwise a serious waste of ammunition would take place. These limits may be theoretical or practical; the first case postulates a very good shot making no mistakes, and knowing the exact distance; the second assumes that two factors, at least, will always militate in the field against attaining the theoretical result, viz., errors in aiming, and errors in estimating distance.

First, with regard to the theoretical limit: if infantry fire against infantry the largest objective is a standing man, 1.60 m. or 5 feet 4 inches high; turning to Table 1, it will be seen that the height of the shot group at 600 m. is 1.58 m., and its width 1.26 m.; this may be taken to represent a group of three men standing side by side; hence a perfect shot, knowing the exact distance, may have a chance of putting 91 per cent. of his shots into these

three men. But if this same man, under similar conditions, were to fire at a standing man at 700 m. nearly a fourth of his shots must pass over the man's head; for the height of the shot group at 700 m. is 2.12 m., whereas the height of a standing man is only 1.60 m. Consequently with regard to firing at infantry the theoretical limit of individual fire may be fixed at 600 m.; provided, that the aim is absolutely correctly taken, that the exact distance is known, and that the objective is not less in size than three men standing side by side. The mere statement of this conclusion is enough to show its eminent unpracticability, and that to let the mass of men fire individually at this distance would lead to an enormous loss of ammunition.

What then is the practical limit for the employment of individual fire in the field? As said before, two factors govern it: errors, in aiming, and in judging distance. Errors in aiming cause either an increase or decrease of angular elevation, and a consequent rise or fall of a bullet on a vertical target, and it has been stated that these errors range from 3 to 6 and up to 12 millimetres in the first metre measured from the muzzle of the rifle: this is equal to angular errors of about 10, 20, 30 minutes, and gives rise to a vertical displacement of:—

0.30 m.	....	0.60 m.	....	1.20 m.	at	100 metres.
1.20 "	....	2.40 "	....	4.80 "	"	400 "
1.50 "	....	3.00 "	....	6.00 "	"	500 "
1.80 "	....	3.60 "	....	7.20 "	"	600 "

But though the vertical displacement increases with the distance, the horizontal decreases; for example, at 200 m. an error of 1 minute gives rise to a horizontal displacement of about 8 m., whereas at 500 m. this is reduced 5 m., and at 1,000 m. to 3 m.

Assuming that under the circumstances of firing at an enemy, the majority of men fire high with the minimum error of 10 minutes, their shots at 400 m. will be raised 1.2 m. above the ground; if to this be added half the height of the shot group at this distance, 0.42 m., the centre of the gerbe will be 1.62 m. high; that is, the mean trajectory will just clear the heads of standing men. Again at 500 m. the mean trajectory will be 2.09 m. above the ground, 0.49 m. above the head of a standing man. Hence on account of inaccuracies in aiming, and the tendency men have to fire high in action, the limit of individual fire from this point of view should be fixed at 400 m.

With regard to errors in estimating distance, taking into account the difficulty of judging distance in action, it is fair to assume that errors of a tenth of the distance up to 300 m., a seventh up to 600 m., and a sixth up to 1,200 m., will be committed. In Table 12, the probable errors in judging distance from 400 m. to 600 m. are compared with the extent of ground swept by the entire gerbe at each distance, assuming that the objective is a standing man, 1.60 m. high. From this table it will be seen that at 400 m., errors in judging distance can cause but few shots to miss, as the zone swept by the entire gerbe is 106 m. in extent, while the probable miscalculation of distance is only 57 m. At 450 m. these spaces are practically equal, and most of the shots will hit the objective; but at 500 m. an error of 21 m. will prevent any shots striking the object; hence from this standpoint the limit of individual fire must be fixed at 450 m.

Taking both the above factors into consideration, the limit of effective individual fire at standing men may be placed at 400 m. or 450 yards for the great majority of men, but a good shot, knowing the exact distance, may be permitted to fire up to 600 m. or 650 yards. The limit of individual fire at kneeling men may from similar calculations be placed at 400 m. or 450 yards for good shots, and at 250 m. or 275 yards for ordinary men; lastly, the limit for individual fire at men lying down may be fixed at 200 yards.

Royal United Service Institution.

MEMORANDUM FOR 1884.

The Council having decided that a Gold Medal be granted annually for the best Essay on a Naval or a Military subject, make known the conditions of competition:—

- (1) The Candidates must be Members of the Institution, or persons eligible to become Members, according to the following Extract from the Bye-laws, Section II., paragraphs 1 and 2, viz. :—
 1. "Princes of the Royal Blood; Lords Lieutenant of Counties; Governors of Colonies and Dependencies; Officers of the Army, Navy, Marines, Her Majesty's East Indian Military and Naval Forces, Militia, Yeomanry, Royal Naval Reserve, and Volunteer Corps, shall be entitled to become Members *without Ballot* of the Council.
 2. "Ex-Governors of Colonies and Dependencies; Officers who have quitted the Service; Deputy Lieutenants of Counties; Civil Functionaries who are or have been attached to the Naval and Military Departments; the Master, Deputy-Master, and Elder Brethren of the Trinity House; and Army and Navy Agents; shall be *eligible* to become Members by *Ballot* of the Council."
- (2) The subject for this year shall be of a Military character.
- (3) The Essays must not exceed 48 pages (exclusive of tables), of the size and style of the "Journal," each page averaging 540 words.
- (4) The Essays must be received by the Secretary, on or before the 1st NOVEMBER, 1884, except in the case of those forwarded from India, China, the Pacific, and Australia, which will be received to the 1st DECEMBER.
- (5) The Essays must be strictly anonymous, but each to have a Motto, and to be accompanied by a sealed envelope with the Motto written on the outside, and the name of the Candidate inside.
- (6) The Essays will be submitted for decision to three Referees chosen by the Council; but no award will be made by them in favour of any Essay which does not, in their opinion, attain a sufficient standard of excellence.
- (7) The award of the Referees will be made known, and the Medal will be presented to the successful Candidate (or his representative) at the Anniversary Meeting, and his Essay will be printed in the "Journal."

The following is the subject for the Essay for the present year:—

"Should the European Army in India continue as at present constituted, or should it be converted in whole or in part into a local force?"

By Order,

B. BURGESS, CAPTAIN,

Secretary.

WHITEHALL YARD, LONDON

1st January, 1884.

PART II.

COLLECTIVE FIRE.

Before proceeding to an examination of the action of collective fire, it is well again to point out, that the limits for individual fire laid down in the first part of this paper apply solely to the Mauser rifle: a rifle with a lower trajectory would have a flattened gerbe, with diminished transverse section, and hence the limit for its employment in individual firing would extend beyond that fixed for the Mauser; still, at the same time, the principles on which these limits are fixed remain the same in both cases. Similarly, in the following discussion, the action of the Mauser rifle will alone be under review, but the principles which underlie its usefulness in collective firing will apply to any other rifle; hence the study becomes useful as a clue to the study of the action of all rifles.

Collective fire, as said before, is "the fire of several men acting together under the orders of a superior," and since at 400 m., the limit of individual fire from the Mauser rifle is reached, the action of collective fire must be studied from 450 m. onwards.

Method of Obtaining a Record of the Result of Collective Fire.

The plan adopted in Germany to obtain a record of the flight of bullets is approximately the same as that in France, Italy, Austria, and England; but, since fuller details of the method of conducting these researches are published in the first-named country, the German plan will be described as a type of how such investigations are generally carried out.

The effects of collective fire have been determined in Germany by means of experiments on a large scale carried out at the Musketry School at Spandau. The experiments extended over a considerable length of time, and were executed by firing a great number of rounds in order to reduce to a minimum all abnormal influences. The men firing were relieved from time to time, and were sent to Spandau from their regiments only a few days before taking part in the experiments; they were second and third class shots, that is, men respectively in their second or first year's service; they were in marching order, and had to make a march of some hours before arriving on the practice ground. The fire was conducted by means of volleys fired by men lying down using rests, and at targets 1·80 m. (6 feet) high and 20 m. (22 yards) wide. The number of men firing varied from 10 to 50, as a rule 25 were employed; the number, experiments have shown, has hardly any influence on the results, provided there are at least 10 men firing. The men were extended over 20 m., a space equal to the extent of the target, and were ordered to aim straight to their front and at the bottom of the first target of the series.

Care was taken to choose a flat surface parallel to the line of sight, on which to place the targets, thus the tops of all the targets of the series were practically level. The targets were made of some slight material covered with paper, and stretched on easily movable frames. They were arranged in column, and were separated by distances deduced from the total theoretical length of the dangerous zone, in such a manner that a bullet which grazed the top of one target struck the bottom of the target next behind it; under these conditions, each bullet theoretically left but one mark on the entire series of targets. The intervals between the targets are shown in Table 13, which is a copy of Appendix L of the German Musketry Instructions of 15th November, 1877. In order that all the shots should be registered, the targets had a depth of 150 to 200 m. when a single sight was used, and a depth of 300 to 400 m. when two sights, with a difference of 100 m. between them were employed. For example, with the line of sight of 600 m., the

targets were placed at 535, 586, 629, 669, and 700 m., thus having a depth of 165 m.

When the firing was concluded the number of hits were counted to verify that each bullet had left but one mark of its passage ; then the position of the hits on each target were taken off, and from this vertical record the horizontal representation of the graze of each bullet was calculated.

General Results of Collective Fire.

Such is the method by which the data for the examination of the action of collective fire was obtained in Germany. The results, broadly speaking, are that the hits spread remarkably evenly over a space lengthened in the direction of the line of fire and depending for breadth on the extension of front given to the fire. A nucleus shown by a slightly denser grouping of the hits, appears towards the centre of the surface struck ; the hits outwards to the periphery becoming more and more scattered. The regularity with which the hits are distributed is due to the reciprocal action of the different influences which tend to make the bullets spread, and it is to this reciprocal action that the great value and great certainty of collective fire is due. The longitudinal dispersion remains nearly constant at all distances, and up to 1,400 m. it has even a tendency to diminish ; this is due as said before to the fact, that the same angular error in elevation has a diminished influence on the range of the bullet in proportion as the distance is increased.

Construction of Tables to show the Result of Collective Fire.

In order to arrive at the value of the experimental firing, the results obtained on a series of targets placed as before described are decomposed, under the supposition that targets 1·80 m. high, and equal in width to the gerbe, are placed at intervals of 10 m. along the entire path of the bullets ; then the number of hits which would have struck each of the targets is calculated, and thus the terms of the series required are obtained. For example, in order to find the number of hits in a target at 400 m., it is only necessary to count the number of grazes that lie between its position and that of a parallel target 75 m. in its rear, since the bullets making the grazes must have passed within 6 feet of the ground at 400 m. ; the dangerous zone or "margin" of the 400 m. trajectory with reference to a 6 feet target having a depth of 7·5 m.

The target which receives the largest number of hits is called the nucleus of the series.

Table 14 "A" (K_1 No. 1, G.M.I.) gives the destructive effect of a collective fire with a single sight against a series of targets 1·80 m. high and 20 m. wide ; that is, against fifty men standing side by side. And also the effect of the same fire on a company column, the men standing ; this is obtained by adding the depth of the column to the extent of the dangerous zone and counting the number of grazes which lie in this space.

Table 14 "B" (K_1 No. 2, G.M.I.) gives the destructive effect of a collective fire with a single sight against a series of targets 45 cms. high and 20 m. wide ; that is, against fifty men lying down side by side, not under cover ; and also the effect of the same fire on a company column lying down, this is obtained in the same way as described above.

Table 15 "A" (No. 3, K_2 , G.M.I.) gives the effect of a collective fire with two sights against a target 1·80 m. high and 20 m. wide, *i.e.*, against fifty men standing side by side.

Table 15 "B" (No. 4, K_2 , G.M.I.) gives the number of men's breadths (0·40 m.) struck by a collective fire with two sights ; this is obtained by dividing, in the direction of the line of fire, the horizontal representation of the grazes into bands 0·40 m. wide, and then at each distance counting the

number of bands which in a length equal to the dangerous zone at the distance have one or more grazes on them. For example, at 500 m., when the 500 m. and 600 m. sights are combined thirty-four men's breadths are hit; that is, on each of these men's breadths extending 65 m. (equal to dangerous zone at 500 m.) behind the target, there has been counted one or more grazes, with the same fire at 600 m. forty-one men's breadths are hit.

Observations on the Series obtained from the Use of One Sight.

"a." The length of a series from the first term to the last represents the depth of what is called the "dangerous ground." See Plate XXV, Fig. 4.

"b." In the tables, the sum of any series does not represent the number of bullets that have struck the targets, as the same bullet may traverse several successive screens; for example, the bullet which grazes the top of the screen at 400 m. will pass through the next seven screens, since the margin of the 400 m. trajectory is 75 m., and the screens are arranged at intervals of 10 m. apart.

"c." The position of the nucleus of the shots of a series has been found to be about half the length of the "margin" in front of the target up to 700 m.; this is caused by the aim being taken at the foot of the first target of the series. After 700 m. the position of the nucleus corresponds practically with that of the object fired at; this is due to the shading off of all objects at a distance, and the consequent unconscious tendency of the firer to aim more at the centre of his mark.

The "margins," or dangerous zones of the Mauser rifle, depending on a target 1·80 m. high are as follows:—

75 metres at 400 metres.				17 metres at 1100 metres.			
65	"	500	"	15	"	1200	"
48	"	600	"	13	"	1300	"
38	"	700	"	12	"	1400	"
32	"	800	"	10	"	1500	"
25	"	900	"	9	"	1600	"
20	"	1000	"				

The position of the nuclei in front of the target as taken from the tables are:—

35 metres for 400 metres sight.			
30	"	500	"
21	"	600	"
18	"	700	"

By doubling the above numbers and comparing them with the extent of the dangerous zones at the same distances, it will be seen that the position of the nuclei in front of the object aimed at is practically one half of the extent of the dangerous zone.

Distances.	Position of nuclei.		Extent of dangerous zone.
400 metres.	35 metres	$\times 2 = 70$ metres.	75 metres.
500 "	30 "	$\times 2 = 60$ "	65 "
600 "	21 "	$\times 2 = 42$ "	48 "
700 "	18 "	$\times 2 = 36$ "	38 "

"d." The terms of the series in the several tables were obtained, as said before, by means of a large number of experiments; consequently the firing of 100 rounds will not give exactly the same results; but the approximation will become closer as the number of rounds fired is increased. At the same time the length of the series will not vary considerably whether the number of rounds fired be either increased or diminished, provided the number is not

reduced below fifty, which is the minimum number required to show clearly the grouping of the hits.

"e." The term "the effective dangerous ground," see Plate XXV, Fig. 4, has been applied to the space contained between the first imaginary screen of a series which has received ten hits, and the last which has received the same number. With the sight of 400 m. when firing at the 180×20 m. target, this ground commences 140 m. in front of the nucleus and ends 70 m. behind it, and hence has an extent of 210 m. In the same manner, with the sights of 500 m. and 600 m. its length is 200 m. and 170 m. respectively. With the 800 m. and the 1,000 m. sight the effective dangerous ground is 110 m. in extent. In the effective dangerous grounds from 400 to 900 m. at least one-tenth of the rounds fired are effective.

The following table extracted from the German Musketry Instruction of 28th September, 1875, is interesting from this point of view.

Table 16.

Sight.	Number of rounds fired.	Depth of effective dangerous ground.	Approximate number of hits	
			At the limits of the effective dangerous ground.	At the nucleus.
Metres.				
400 to 600	100	150	15	50 to 70
700 to 800	100	100	10	30
900 to 1200	200	100	10	30 to 50
1300 to 1600	300	100	10	undetermined.

"f." Errors in judging the distance must not exceed half of the extent of the effective dangerous ground, otherwise only a few scattered shots would hit the mark; thus at 500 m. an error of 100 m. would throw almost all the shots off the object; and as here the probable error in judging the distance would be about 70 m. it would not be advisable to use only one sight unless the distance were approximately known; for this reason the German Instructions state that "beyond 400 m. the employment of a single sight does not promise good results unless the mark is stationary, and there is the time and the means to regulate the fire, and finally unless the configuration of the ground in front is not likely to diminish the effectiveness of the fire." "In all other cases, and especially against moving objects which advance or retire, it is necessary to make use of two or more sights having a difference between them of 100 m."

Observations on the Series obtained from the Use of Two Sights.

"a." The series representing the effect of a collective fire with two sights having a difference of 100 m. between them, have not been determined directly by experiment. Thus to find the terms of the combined series with the 600 m. and 700 m. sights, it is necessary to add to the terms of the series with the 600 m. sight, the terms of the series with the 700 m. sight. Table 17 shows how this is effected.

"b." The effective dangerous ground when two sights are employed has a greater depth than when only one sight is used, and this with an equal consumption of ammunition. For example, if reference be made to Table 17 it will be seen that with one sight, and an expenditure of 200 rounds, this ground

extends from 510 m. with twenty-two hits to 690 m. with ten hits ; that is to say, it has a total depth of 180 m. ; but if 200 rounds are fired with the combination of the 600 and 700 m. sights, then the depth of the effective dangerous ground is extended to 260 m.

The mingling of these two series is graphically shown in Plate XXV, Fig. 4.

In firing with two sights up to 700 m., and with three sights up to 1,200 m., the extent of the ground swept by the bullets is such, that the effects of errors in judging distance, of atmospheric influences, and of those due to the bullets falling on sloping ground, are eliminated ; and thus the shots can be grouped around the objective. Table 18 shows the grouping of shots when the 1,100, 1,200, and 1,300 m. sights are employed together, the effective dangerous ground will be seen to extend uninterruptedly from 1,090 m. to 1,220 m., and thence with three gaps to 1,300 m. The total effective depth may be taken as 130 m., but the probable error in judging distance at 1,200 m. amounts to 180 m. Therefore, since the effective dangerous ground at any range should at least be double the amount of the probable error in judging distance at that range, the firing of 300 rounds under the above conditions would be ineffective so long as the distance from the objective was not accurately known. If twice 300 rounds were fired Table 18 shows that the effective dangerous ground would have a depth of 300 m., extending from 1,040 to 1,340 m., hence under these conditions, if a rough approximation of the distance could be obtained the fire would be effective, but if not known, it would be only partially effective. This reasoning applies, of course, to the Mauser rifle, but given a rifle with a flatter trajectory, causing consequently a greater dispersion of bullets at long ranges, then a combination of three sights would be effective at a considerable distance beyond 1,200 m. The above shows that in long-range firing the amount of ammunition required to produce the required effect must be carefully determined for each case as it arises ; hence the decision as to the employment of this kind of fire must be retained in the hands of the senior Officers of the battalions.

Returning to the discussion of the use of two sights, it has been found that, as a rule, when firing 100 rounds, the number of hits on the screens does vary very much from the number made when only one sight is employed. Table 19 gives the percentage of hits when the 600 and 700 m. sights are used together, and when only the 600 m. sight is employed.

Before proceeding further it is advisable to obtain some idea, by means of experimental data, supplemented by theoretical deductions, of the vertical grouping of the hits, and of the shape of the gerbe in collective firing, in the same manner as the different trajectories were analyzed in individual firing. It will be useful to compare the depth of the ground struck as calculated from the above theoretical conditions, with its actual extent as derived from experimental firing, and thus to bring out the several reciprocal influences which determine the dispersion of the bullets.

The Dimensions of the Shot Groups in Collective Firing.

The factors which govern the size of the shot groups in collective firing are, "a." Differences in the rifles. "b." Errors in aiming.

"a." *Differences in the Rifles.*—If a certain man fire 100 rounds, and make use of ten different Mauser rifles, it has been found that the hits on the target have a greater vertical extension than the major axes of the shot groups as shown in Table 1, which are derived from the firing of the same man with the same rifle. This increase in vertical dispersion is due to differences in the construction of the rifles, and to differences in the treatment it has received while in the soldier's possession. In fact, in spite of the progress made in modern industry, it is impossible to obtain products perfectly identical to each other, and even if this were attainable, the

different usages rifles are subjected to would, after a year or two, create differences which would influence the grouping of the shots on a target. Experience has shown that after the Mauser rifles have been in use two years, an angular error in elevation of 0.333 m. in 100 m. has supervened; therefore in collective firing this addition has to be made to the major axes shown in Table 1. For example, at 300 m. the major axis would be $3 \times .333 + 0.58$ m. (the major axis in individual firing at 300 m.) or 1.58 m.

"b." *Errors in Aiming*.—If several men fire with different rifles it is found that the vertical axis is greater than the one calculated as above, this is due to each man making use of a different amount of foresight; the difference between a full and a fine sight in the Mauser rifle has been found to cause an angular error in elevation of about twenty minutes. But experience has shown that men firing, even when making use of a rest in the lying down position, commit errors in aiming, of thirty minutes, this amount, therefore, must be added to that caused by differences in the rifle. In consequence, in order to obtain the vertical axis of the shot group at 400 m., it is necessary to add to the dimensions given in Table 1, viz., 0.84 m., the maximum amount of error due to differences in the rifles, viz., $4 \times .333 = 1.333$ m.; the total 2.17 m. gives the vertical dispersion due to the arm: to this must be added the proximate amount of personal errors in aiming, viz., $4 \times .873 = 3.49$ m. (0.873 m. being the value of the natural tangent of 30 minutes at 100 m.), the grand total $2.17 + 3.49 = 5.66$ is therefore the vertical axis of the shot group in collective fire at 400 m. These calculations are made in Table 20.

There is no need to calculate the breadth of these shot groups, as it is assumed that the front under fire depends on the extension given to the troops firing.

In Table 20 is also given the mean trajectory of the 1,600 m. sight extracted from Table G., G.M.I., and from this is calculated the upper and lower trajectory of the 1,600 m. gerbe by means of the addition to, or subtraction from it, of half the height of the shot groups at the several distances as shown in column 5 of the same table. In a similar manner the trajectories of the gerbes of all the lines of sight from 400 m. to 1,500 m. can be calculated.

The Depth of the Ground struck and of the Dangerous Ground as obtained by Calculation, compared with the Results derived from Experimental Firing.

The distinction between the terms dangerous zone and dangerous ground will be more clearly understood if reference is made to Diagram 5; in which the track of a gerbe, from its lower edge first touching a 6-foot target to its upper trajectory meeting the ground, is clearly indicated. This diagram, with regard to the "zone swept by the entire gerbe," applies chiefly to individual fire as beyond 600 m., the height of the shot groups exceeds that of the target.

Looking at Plate XXV, Fig. 5, and imagining that the line T_1G_1 is a straight line, then the angle T_1G_1T represents the angle of the drop of the bullet; and since T_1T equals half the depth of the gerbe at the extreme range of the sight used, and TG_1 equals half the extent of the ground struck: then the extent of the ground struck is equal to the vertical height of the shot group, corresponding to the distance of the sight employed, divided by the tangent of the angle of the drop at the same distance. For example, with the 900-m. gerbe the vertical height of the shot group at this distance is from Table 20, 14.63 m.; the angle of drop is $4^\circ 20'$, and its tangent is .07578, consequently the extent of ground struck is $\frac{14.63}{.07578}$, or 193 m.

In Table 21 these calculations are made for all distances between 400 and 1,400 m.

If to the length of the ground struck is added the depth of the dangerous

zone, the extent of the dangerous ground is obtained. The depths of these "dangerous grounds" thus calculated are inserted in column 6 of Table 21, and by their side, in column 7, are placed the extent of the several dangerous grounds extracted from Table 14, "A," and obtained from direct experiment. The small differences which exist between the results obtained by either method, prove the correctness of the considerations which have formed the basis of the calculations. The mean depth of the dangerous ground as obtained by calculation is 226·8 m., and 228 m. as obtained from experimental firing, the average difference between these amounts being only 1·40 m.

The Reciprocal Action of the Causes which produce the Dispersion of the Shots.

If Table 20 be examined it will be seen that up to 1,000 m. the vertical dispersion due to errors in aiming exceeds the vertical dispersion due to the Mauser rifle, and that from 1,000 m. to 1,600 m. the reverse takes place. This shows that in estimating the value of different rifles it is not only necessary to compare the flatness of their trajectories and the accuracy of their shooting, but it is also necessary to compare the extent of the spread of the bullets when a dozen or more different rifles of the same pattern are made use of in collective fire. The pattern of rifle which, under these circumstances, gives rise to a denser and a more regular grouping of hits will be the best, and have the most destructive effect in the field. There is no method more searching for testing the value of different patterns of rifles than the rigid comparison of the series of terms obtained from long-continued collective firing.

Modification in the Series when the Conditions of the Firing are changed.

If the men, though still firing from a rest, are less skilful, and make errors in elevation in excess of 30', the series will be lengthened, and the shots in the nucleus and in the adjoining screens will be less dense, and, further, the series will be less regular in character. By employing men still less skilful in firing all these irregularities will be accentuated, and it may happen that gaps will appear in the series in the neighbourhood of the distance corresponding to the sight in use.

When the firing takes place without rests the series is much lengthened and becomes irregular; the destructive effect of the gerbe ceasing in some places. These gaps are more numerous and nearer the distance corresponding to the sight in use in proportion as the inaccuracy of the firing increases. This proves the incorrectness of the statement, that collective fire is the negation of all musketry instruction. On the contrary, representative series show, by the modifications they undergo when deduced from the firing of bad shots, that the drilling and careful instruction of the soldier carries as much weight and has as much influence on collective fire as it has on individual fire. The skill of the firers is so much the greater as the record of their shooting gives a more regular, more continuous, and denser series. From this it follows that the collective fire of several men at a single target at distances over 400 m. is not the true gauge of their efficiency. It is necessary that they fire at a series of screens, which will register all the hits; then from their density an estimate of the value of their shooting can be obtained. The position of the nucleus offers no clue, as it does not depend on the efforts of the men, but on factors beyond their control.

Atmospheric conditions have their influence on firing; thus, temperature lower than 3° C. (the sight of the Mauser rifle is adjusted to 2·5° C.) would cause the series to be less dense than the normal one, while the series would become denser if the temperature rose above 3°; not taking into account, of course, the hygrometric state of the air. An atmosphere more or less warm has the effect of advancing or retiring a whole series with reference to its normal position. Between -3° and +3° a fall of one degree displaces the

series towards the firing point; about 4 m. at 100 m., 8 m. between 200 and 300 m., and 12 m. between 400 and 1,200 m. On the other hand, each rise of one degree between 3° and 16° removes the series further back: 2 m. between 0 and 300 m., and 4 m. between 400 and 1,200 m.

The deviations in the range of the bullets, due to the influence of temperature, are similar to the deviations due to errors in aiming, nearly constant, and diminish instead of increasing at distances beyond 1,200 m. The hygro-metric state of the air sometimes counterbalances this increase of range, as it has been found that, when the ground is much heated by the sun, the most densely saturated layer of air is at a certain distance above the ground; and, consequently, acts as a retarding force more powerfully on the high trajectories than on the lower ones. With a temperature of 15°C . (58.5°F .) the shot groups of the Mauser rifle will be displaced 48 m. away from the firing point, if the firing is at 400 yards. But as at this distance aiming at the foot of the target has the effect of bringing the nucleus 35 m. towards the firing point, the deviation in range caused by an elevation in temperature, approximating to the mean temperature of Central Europe, is compensated up to 700 m. by the practice of aiming at the foot of an object.

Modifications caused in the Series by the Ground on which the Objective rests, rising or falling with reference to the Line of Sight.

The next point to consider is, how the dispersion of the bullets is affected by the slope of the ground on which they fall. Mathematical proof need not be given to show that when ground rises with reference to the line of sight, the extent of the ground struck is diminished, and that the contrary takes place when the ground falls; nor to prove the corollary that the density of the hits is increased in the first case and diminished in the second.

Still the length of the dangerous ground under all circumstances requires to be known, and therefore the following calculations must be made:—Let G represent the vertical axis of the shot group in collective firing at any selected distance, α the angle of the normal drop of the bullet at this same distance, and α' the angle of the actual drop of the bullet on a surface inclined with reference to the line of sight; let x equal the interval which must exist between the terms of the new series—bearing in mind that the intervals in the normal series are 10 metres—and n represent the number of terms in each series; then, since the extent of the dangerous ground is equal to the depth of the ground struck, added to the depth of the dangerous zone, the following equations are arrived at:—

$$10n = \frac{G}{\tan \alpha} + \frac{1.8^{\circ}}{\tan \alpha} = \frac{G + 1.8^{\circ}}{\tan \alpha}$$

$$nx = \frac{G}{\tan \alpha'} + \frac{1.8^{\circ}}{\tan \alpha'} = \frac{G + 1.8^{\circ}}{\tan \alpha'}$$

for $\frac{G}{\tan \alpha}$ and $\frac{G}{\tan \alpha'}$ represent the ground struck

and $\frac{1.8^{\circ}}{\tan \alpha}$ and $\frac{1.8^{\circ}}{\tan \alpha'}$ the extent of the dangerous zone.

$$\text{then } \frac{x}{10} = \frac{\tan \alpha}{\tan \alpha'} \text{ and } x = \frac{10 \tan \alpha}{\tan \alpha'}$$

Substituting the value of x for the 10 m. in the normal series and multiplying by the number of terms in the same series, the extent of the dangerous

ground can be obtained for all slopes and at all distances. The preceding calculations must not be thought to be applicable on the field of battle where tactical considerations are dominant, but still they serve their purpose by pointing out how the slopes of ground affect the destructive action of collective fire, and from this information serviceable tactical rules can be deduced.

In Table 22 the reduction in length of the normal 10 m. intervals are shown for distances between 400 and 1,600 m., and when the ground rises respectively 3°, 5°, or 10°. The following examples will show how the calculations have been made.

Example.—Find the length of the interval which separates the different terms of the 400 m. line of sight when firing at an object on an ascending slope of 3°.

In Appendix G₃, G.M.I. of 1877, the normal angle of the drop of a bullet at 400 m. is stated to be 1° 8' 16"; for all practical purposes 1° 10' is sufficiently near. The actual angle of the drop of a bullet when the ground on which the bullet falls rises with reference to the line of sight is equal to the normal angle of drop added to the angle which the slope of the ground makes with the line of sight; and when the ground falls, to the normal angle of drop diminished by the angle formed by the slope of the ground and the line of sight. Applying the above data and calling x the reduced interval required, we have from the preceding equation—

$$\frac{x}{10} = \frac{\tan 1^\circ 10'}{\tan 4^\circ 10'} = \frac{.02037}{.07286}$$

$$\text{and } x = \frac{.2037}{.07286} = 3 \text{ m.}$$

If Table 22 be examined, it will be seen that when firing at an object on an ascending slope, the normal extent of the dangerous ground, and in consequence the extent of the ground struck by all the bullets in the gerbe, is diminished by one-half; at 800 m., when the slope is 5°, at 1,000 m. when the slope is 5°, and at 1,500 m. when it is 10°.

Depth of the Effective Dangerous Ground when the Surface on which the Bullets fall is not parallel to the Line of Sight.

It has been said before that when the value of the interval of a series derived from collective fire at an object on a slope has been obtained, it is easy to calculate the corresponding extent of the effective dangerous ground, but an example may make this clearer.

Example.—Find the length of the dangerous ground at 600 m. when the ground which receives the bullets makes an ascending angle of 5° with the line of sight. Referring to Table 14, "A," it will be seen that the extent of the normal effective dangerous ground with the 600 m. sight is 170 m., and that it contains seventeen terms. Looking at Table 22, the length of each term of the series with the 600 m. sight, when employed against a slope of 5°, will be found to be 3 m.; consequently the effective dangerous ground is 17×3 or 51 m.; thus the effect of firing against a slope of 5° is at 700 m. to reduce the effective dangerous ground from 170 m. to 51 m.

Table 23 contrasts the extent of the effective dangerous ground when fire is directed on an ascending slope with its extent when the fire takes place on a plane. It may be observed that the mean length of the effective dangerous ground at distances between 400 m. and 1,400 m. is 134 m., and that for the slopes of 3°, 5°, 10°, its mean length is reduced respectively to 70, 54, and 30 m.; in other words, when fire is directed at ascending slopes forming angles of 3°, 5°, or 10° with the line of sight, the effective dangerous ground is approximately one-half, one-third, or one-fourth the length of the effective dangerous

ground under normal circumstances ; and, similarly, when the bullets fall on descending slopes, making angles of 3° , 5° , or 10° with the line of sight, the extent of the effective dangerous ground is approximately double, treble, or quadruple the length of the normal effective dangerous ground.

Tactical Considerations.

Before concluding it may be pointed out how the foregoing study may be utilized with reference to tactical questions ; for instance, the length of the dangerous ground in the different series serves to determine the distances which should separate the different échelons during an attack or when on the defensive. It is clear that the placing two lines under the influence of same gerbe is to be avoided whenever it is possible ; but since the extent of the dangerous ground increases the nearer the enemy is approached, the paradox is arrived at, that the nearer the front line is to the enemy the further the supports should be from it. This difficulty is met by placing as many rifles as possible in the front line of the attack from its very commencement, and by keeping the supports about 500 yards in rear, and thus clear of the fire directed at the front line. Under these circumstances, the strong front line would be able to push rapidly and energetically forward until checked by some serious opposition. During this halt, and while preparing for a further advance by trying to dominate the enemy's fire, the front line would be strong enough, if a counter-attack were made, to hold it in check sufficiently long to give time for the supports to come up. The supports, if not thus required, would remain outside the influence of the fire aimed at the front line until the losses in it necessitated its being reinforced.

Again, a study of the series helps to show the relative amount of losses due to different formations at different periods of an action. Thus in the German Musketry Instructions it is stated, that a standing company column up to 700 m. suffers little more loss than a line, but beyond this distance, and up to 1,600 m., its losses are more than double those of a line ; while a company column lying down must expect losses double or treble those of a line lying down.

A consideration of the data connected with the influence of slopes on the dispersion of bullets, leads to the conclusion, that when the ground on which the objective rests, makes an ascending angle of over 3° with the line of sight, it is advisable to make use of a combination of two sights, and to employ three sights, if the slopes be steeper still. Whereas, if the ground slopes away from the line of sight, one sight only should be made use of.

The study of the blending of gerbes when two or more sights are made use of leads to the impression that a single line of men cannot give full effect to the deadly power of long-ranging rifle-fire ; hence arises the idea of double tier fire, or the firing of one line of men over the heads of another line at the same object : possibly to be realized on the defensive on some prominent spur commanding and flanking the enemy's line of approach ; possibly, if time admits, in a skilful arrangement of shelter trenches, and, lastly, to be carried out in earthworks intended to act as supports in a position, or as an outer line of defence around some important village or town.

Before quitting this part of the subject a few words must be said as to the method of employing collective fire in the field. Looking at its mode of action, viz., the simultaneous discharge of many rifles at the same object, its effect may be likened to that of a blow ; hence, like a blow, it must be delivered with rapidity ; the number of rounds allotted to it must be discharged at the same time ; a pause would then take place, the smoke would be allowed to clear off, the men's nerves would become steadied, and then, if required, another blow could be struck ; or, a certain number of blows might be given rapidly, one after the other. The suddenness with which such fire

would be delivered, and its intermittent nature, would have a moral effect on the enemy ; it would create a feeling of suspense, and prevent the nerves of the men getting accustomed to the ping of the bullets. Further, as collective fire should not be carried out by a less number of men than 100, its employment, as a rule, should be directed by a battalion commander ; and in his hands it is probable that no waste of ammunition would be permitted, as the objective would be well selected, its distance fairly estimated, and the result of the fire carefully studied.

Conclusion.

Having travelled over many paths, branching one from the other, it may be well, in conclusion, briefly to summarize what are the salient features connected with the combination of two or more sights in collective fire. The advantages claimed for this system of firing at all distances beyond the limits of individual fire, fixed at 400 m. for the Mauser rifle, are—that it counterbalances the loss of effect in rifle-fire due to moving objectives, errors in judging distances, deviations caused by atmospheric influences, and the shortening of the dangerous ground resulting from the surface on which the bullets fall not being parallel to the line of sight. The mere statement of these facts brings at once to mind the number of situations in war where the employment of this kind of fire would have a marked influence on the fortunes of the day ; and no more important tactical problem awaits the test of practical experience than that of how best to utilize collective fire on the field. The plan must be thought out in peace-time, and practised in war ; not to make use of the full power of the infantry rifle is like asking a man to defend himself with one hand tied behind his back. Whatever power is latent in rifle-fire must be drawn out, and no impediment should be placed in the way of obtaining the necessary data on which to formulate a decision.

And now, at the conclusion of this paper, as at its commencement, my indebtedness to the articles in the “*Revue Militaire de l'Étranger*,” on the German Musketry Instructions, must again be acknowledged ; tables have been bodily extracted from them, entire paragraphs have been copiously used, and arguments and deductions freely borrowed. Thus my paper lays no claim to originality, but is merely a critical collection and arrangement of data connected with rifle-fire ; useful perchance at this time, when all Officers are studying the theory as well as the practice of musketry.

Table 1.

Dimensions of the shot groups of the Mauser rifle.				
Distances.	Major-axis.	Minor-axis.	Per cent. of abnormal hits deducted from those taken off.	Remarks.
m.	m.	m.	per cent.	
100	0·16	0·16	1	
150	0·24	0·24	2	The size of a man's head.
200	0·34	0·32	3	
250	0·44	0·40	4	The breadth of a man.
300	0·58	0·48	5	A little broader than a man.
350	0·68	0·58	6	
400	0·84	0·68	7	
500	1·18	0·96	8	A little broader than a group of two men.
600	1·58	1·26	9	The height of a 5 ft. 3 in. standing man.
700	2·12	1·68	10	
800	2·80	2·12	11	
900	3·78	2·64	12	More than twice the height and six times the breadth of a standing man.
1000	4·74	3·24	13	
1100	6·06	3·88	14	
1200	7·60	4·60	15	
1300	9·64	5·34	16	
1400	12·12	6·12	17	
1500	15·12	6·96	18	It is necessary to place eight targets 1·8 m. high and 6·9 m. wide at 10 m. from each other in order to intercept 82 per cent. of the hits.
1600	18·72	78·6	19	It is necessary to place ten targets 1·80 m. high and 7·86 m. wide at 9 m. apart in order to intercept 81 per cent. of the hits.

Table 3.

Ordinates of the upper and lower trajectories of the 350 m. gerbe above a horizontal plane, or one sensibly parallel to the line of sight, according as the firer is standing, kneeling, or lying down, and aim taken at the foot or centre of the target at the several distances named below.

Distances.	Upper trajectory.				Lower trajectory.			
	Foot of the target.		Centre of the target.		Foot of the target.		Centre of the target.	
Metres.	m.	c.	m.	c.	m.	c.	m.	c.
50.....	0	61	1	51	0	53	1	43
100.....	1	08	1	98	0	92	1	82
150.....	1	37	2	20	1	13	2	03
200.....	1	46	2	36	1	12	2	02
250.....	1	34	2	24	0	90	1	80
300.....	0	99	1	89	0	41	1	31
350.....	0	34	1	24	0	34	0	56

Table 4.

Ordinates, at intervals of 50 m. above a horizontal plane, of the 350 m. line of sight, according as the firer is standing, kneeling, or lying down, and aim taken at the foot or centre of the target.

Distances corresponding to the ordinates.	Aim directed at the foot of target at 350 m.			Aim directed at the centre of a target at 350 m.		
	Firing.			Firing.		
	Standing.	Kneeling.	Lying down.	Standing.	Kneeling.	Lying down.
Metres. ..	m. c.	m. c.	m. c.	m. c.	m. c.	m. c.
50.....	1 50	0 90	0 30	1 50	0 90	0 30
100.....	1 28	0 77	0 25	1 40	0 90	0 38
150.....	1 07	0 64	0 21	1 32	0 90	0 47
200.....	0 85	0 51	0 17	1 24	0 90	0 55
250.....	0 64	0 38	0 12	1 14	0 90	0 64
300.....	0 42	0 25	0 08	1 06	0 90	0 73
350.....	0 21	0 12	0 04	0 98	0 90	0 81
350.....	..	..	..	0 90	0 90	0 90

Distances corresponding to the ordinates.	Ordinates, at intervals of 50 m. above a horizontal plane, of the mean trajectory of the 350 m. gerbe, according as the firer is standing, kneeling, or lying down, and aim taken at the foot or centre of target.									
	Aim directed at the foot of a target at 350 m.			Aim directed at the centre of a target at 350 m.			Ordinates of ricochets proceeding from the mean trajectory of the 350 m. gerbe.			
	Firing.			Firing.			Aim directed at the foot of a target at 350 m.			
Metres.	Standing.	Kneeling.	Lying down.	Standing.	Kneeling.	Lying down.	Standing.	Kneeling.	Lying down.	
	m. c.	m. c.	m. c.	m. c.	m. c.	m. c.	m. c.	m. c.	m. c.	
50	1 85	1 34	0 82	1 97	1 47	0 95				
100	2 07	1 64	1 21	2 32	1 90	1 47				
150	2 10	1 76	1 42	2 49	2 15	1 80				
200	1 93	1 67	1 41	2 43	2 19	1 93				
250	1 54	1 37	1 20	2 20	2 02	1 85				
300	0 91	0 82	0 74	1 68	1 60	1 51				
350	..	..	..	0 90	0 90	0 90				
360	..	..	..	..	..	..	0 36	0 33	0 30	
380	..	..	..	..	..	..	1 03	0 98	0 89	
400	..	..	..	..	..	..	1 82	1 64	1 48	

Table 6.

Ordinates, at intervals of 50 m. and above a horizontal plane, of the upper trajectory of the 350 m. gerbe, according as the firer is standing, kneeling, or lying down, and aim taken at the foot or centre of the target.													Ordinates of ricochets proceeding from the upper trajectory of the 350 m. gerbe.				
Aim directed at the foot of a target at 350 m.													Aim directed at the foot of a target at 350 m.				
Firing.													Firing.				
Standing.													Standing.				
m. c.													m. c.				
1	50	0	90	0	30	1	50	0	90	0	30	m. c.	m. c.	m. c.			
1	89	1	38	0	86	2	01	1	51	0	99						
2	15	1	72	1	29	2	40	1	98	1	55						
2	22	1	88	1	54	2	61	2	27	1	92						
2	10	1	84	1	58	2	60	2	36	2	10						
1	76	1	59	1	42	2	42	2	24	2	07						
1	20	1	11	1	03	1	97	1	89	1	80						
0	34	0	34	0	34	1	24	1	24	1	24						
0	17	0	18	0	18	..	..	..	..	..	..
..	0	34	0	24	0	16
..	1	02	0	86	0	36

Ordinates of ricochets proceeding from the upper trajectory of the 350 m. gerbe.

Aim directed at the foot of a target at 350 m.

Firing.

Standing.

Kneeling.

Lying down.

Distances corresponding to the ordinates.	Ordinates, at intervals of 50 m. and above a horizontal plane, of the lower trajectory of the 350 m. gerbe, according as the firer is standing, kneeling, or lying down, and aim taken at the foot or centre of the target.									
	Aim directed at the foot of a target at 350 m.			Aim directed at the centre of a target at 350 m.			Ordinates of ricochets proceeding from the lower trajectory of the 350 m. gerbe.			
	Firing.			Firing.			Aim directed at the foot of a target at 350 m.			
Metres.	Firing.			Firing.			Standing.		Kneeling.	
	Standing.	Kneeling.	Lying down.	Standing.	Kneeling.	Lying down.	m.	c.	m.	c.
50	1 81	1 30	0 78	1 93	1 43	0 91				
100	1 99	1 56	1 13	2 24	1 82	1 39				
150	1 98	1 54	1 30	2 37	2 03	1 68				
200	1 76	1 50	1 24	2 26	2 02	1 76				
250	1 32	1 15	0 98	1 98	1 80	1 63				
300	0 62	0 53	0 45	1 39	1 31	1 22				
350	-0 34	-0 34	-0 34	0 56	0 56	0 56	0 68	0 68	0 68	0 68
360	..	..	..	..	..	..	1 06	1 02	0 99	0 99
380	..	..	..	..	..	..	1 81	1 70	1 61	1 61
400	..	..	..	..	..	..	2 57	2 38	2 22	2 22

Table 8.

Ordinates, at intervals of 50 m. and above a horizontal plane, of the 270 m. line of sight, according as the firer is standing, kneeling, or lying down, and aim taken at the foot or centre of the target.

Distances corresponding to the ordinates.	Aim directed at the foot of a target at 270 m.			Aim directed at the centre of a target at 270 m.		
	Firing.			Firing.		
	Standing.	Kneeling.	Lying down.	Standing.	Kneeling.	Lying down.
Metres.	m. c.	m. c.	m. c.	m. c.	m. c.	m. c.
..	1 50	0 90	0 30	1 50	0 90	0 30
50	1 22	0 73	0 24	1 39	0 90	0 42
100	0 95	0 57	0 19	1 28	0 90	0 53
150	0 67	0 40	0 13	1 17	0 90	0 64
200	0 39	0 23	0 08	1 06	0 90	0 75
250	0 11	0 07	0 02	0 94	0 90	0 87
270 .....	..	..	..	0 90	0 90	0 90

Table 9.

Distances corresponding to the ordinates.		Ordinates, at intervals of 50 m. and above a horizontal plane, of the mean trajectory of 270 m. gerbe, according as the firer is standing, kneeling, or lying down, and aim taken at the foot or centre of the target.						Ordinates of ricochets proceeding from the mean trajectory of the 270 m. gerbe.					
		Aim directed at the foot of a target at 270 m.			Aim directed at the centre of a target at 270 m.			Aim directed at the foot of a target at 270 m.			Aim directed at the foot of a target at 270 m.		
		Firing.			Firing.			Firing.			Firing.		
Metres.	..	Standing.	Kneeling.	Lying down.	Standing.	Kneeling.	Lying down.	Standing.	Kneeling.	Lying down.	Standing.	Kneeling.	Lying down.
		m. c.	m. c.	m. c.	m. c.	m. c.	m. c.	m. c.	m. c.	m. c.	m. c.	m. c.	m. c.
50	..	1 51	1 12	0 63	1 78	1 29	0 81	1 78	1 29	0 81	1 78	1 29	0 81
100	..	1 57	1 19	0 81	1 90	1 52	1 15	1 90	1 52	1 15	1 90	1 52	1 15
150	..	1 36	1 09	0 82	1 86	1 59	1 33	1 86	1 59	1 33	1 86	1 59	1 33
200	..	0 94	0 78	0 63	1 61	1 45	1 30	1 61	1 45	1 30	1 61	1 45	1 30
250	..	0 30	0 26	0 21	1 13	1 09	1 06	1 13	1 09	1 06	1 13	1 09	1 06
270	..	..	..	..	0 90	0 90	0 90	0 90	0 90	0 90	0 90	0 90	0 90
300	..	..	..	..	..	..	..	..	..	..	..	..	..
330	..	..	..	..	..	..	..	..	..	..	..	..	..

Table 10.

Distances corresponding to the ordinates. Metres. .. 50 100 150 200 250 270 300 330	Ordinates, at intervals of 50 m. and above a horizontal plane, of the upper trajectory of the 270 m. gerbe, according as the firer is standing, kneeling, or lying down, and aim taken at the foot or centre of the target.												Ordinates of ricochets proceeding from the upper trajectory of the 270 m. gerbe.			
	Aim directed at the foot of a target at 270 m.						Aim directed at the centre of a target at 270 m.						Aim directed at the foot of a target at 270 m.			
	Firing.						Firing.						Firing.			
	Standing.	Kneeling.	Lying down.	Standing.	Kneeling.	Lying down.	Standing.	Kneeling.	Lying down.	Standing.	Kneeling.	Lying down.	Standing.	Kneeling.	Lying down.	
	m. c.	m. c.	m. c.	m. c.	m. c.	m. c.	m. c.	m. c.	m. c.	m. c.	m. c.	m. c.	m. c.	m. c.		
	1 50	0 90	0 30	1 50	0 90	0 30	1 50	0 90	0 30	1 50	0 90	0 30	1 50	0 90	0 30	
	1 55	1 16	0 67	1 82	1 33	0 85	1 82	1 33	0 85	1 82	1 33	0 85	1 82	1 33	0 85	
	1 65	1 27	0 89	1 98	1 60	1 23	1 98	1 60	1 23	1 98	1 60	1 23	1 98	1 60	1 23	
	1 48	1 21	0 94	1 98	1 71	1 45	1 98	1 71	1 45	1 98	1 71	1 45	1 98	1 71	1 45	
	1 11	0 95	0 80	1 78	1 62	1 47	1 78	1 62	1 47	1 78	1 62	1 47	1 78	1 62	1 47	
	0 52	0 48	0 43	1 35	1 31	1 28	1 35	1 31	1 28	1 35	1 31	1 28	1 35	1 31	1 28	
	0 25	0 25	0 25	1 15	1 15	1 15	1 15	1 15	1 15	1 15	1 15	1 15	1 15	1 15	1 15	
	
	
										</						

Table 11.

Ordinates, at intervals of 50 m. and above a horizontal plane, of the lower trajectory of the 270 m. gerbe, according as the firer is standing, kneeling, or lying down, and aim taken at the foot or centre of the target.				Ordinates of ricochets proceeding from the upper trajectory of the 270 m. gerbe.			
Distances corresponding to the ordinates.	Aim directed at the foot of a target at 270 m.			Aim directed at the foot of a target at 270 m.			
	Firing.			Firing.			
	Standing.	Kneeling.	Lying down.	Standing.	Kneeling.	Lying down.	
	m. c.	m. c.	m. c.	m. c.	m. c.	m. c.	
50	1 47	1 08	0 59	1 74	1 25	0 77	
100	1 49	1 11	0 73	1 82	1 44	1 07	
150	1 24	0 97	0 70	1 74	1 47	1 21	
200	0 77	0 61	0 46	1 44	1 28	1 13	
250	0 08	0 04	-0 01	0 91	0 87	0 84	
270	-0 25	-0 25	-0 25	0 65	0 65	0 65	
300	
330	
350	
375	
400	
425	
450	
475	
500	
525	
550	
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1000	
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1100	
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4100	
4125	
4150	
4175	
4200	
4225	
4250	
4275	
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5125	
5150	
5175	
5200	
5225	
5250	
5275	
5300	
5325	
5350	
5375	
5400	
5425	
5450	
5475	
5500	
5525	
5550	
5575	
5600	
5625	
5650				

Table 12.

An approximate comparison between the zone swept by the entire gerbe and the probable errors made in judging distance in the field.

Distances.	Zone swept by entire gerbe.	Probable error in judging distance.
Metres.	Metres.	Metres.
400.....	106	57
450.....	62	64
500.....	21	71
600.....	5	85

Table 13.

Intervals between the experimental targets deduced from the theoretical dangerous zones or "margins."

Number of the target.	Distance from the firing-point.	Number of the target.	Distance from the firing-point.	Number of the target.	Distance from the firing-point.	Number of the target.	Distance from the firing-point.
1	Metres. 300	20	Metres. 1015·4	39	Metres. 1313·3	58	Metres. 1526·4
2	400	21	1034·4	40	1362·2	59	1536·3
3	475	22	1052·9	41	1338·9	60	1546·1
4	535	23	1070·9	42	1351·4	61	1555·8
5	585·8	24	1088·4	43	1363·7	62	1565·5
6	629·1	25	1105·9	44	1375·7	63	1575·2
7	669·1	26	1122·9	45	1387·5	64	1584·8
8	706·1	27	1139·5	46	1399·2	65	1594·3
9	742·1	28	1155·7	47	1410·7	66	1603·8
10	775·6	29	1171·5	48	1422	67	1613·3
11	806·1	30	1186·9	49	1433·1	68	1622·7
12	834·5	31	1201·9	50	1444·2	69	1632
13	860·3	32	1216·7	51	1455	70	1641·3
14	884·5	33	1231·2	52	1465·6	71	1650·6
15	908·7	34	1245·5	53	1476·1	72	1659·8
16	931·8	35	1259·5	54	1486·4	73	1668·9
17	953·9	36	1273·3	55	1496·6	74	1677·9
18	975	37	1286·9	56	1506·6	75	1686·8
19	996	38	1300·2	57	1516·5		

Series with a combination of two sights.

Distances.	Series in the German Musketry Instructions.			Series carried 20 m. towards firing point. ¹			Remarks.
	600 m. sight.	700 m. sight.	Combined 600 and 700 m. sights.	600 m. sight.	700 m. sight.	Combined 600 and 700 m. sights.	
Metres.	100 rnds.	100 rnds.	200 rnds.	100 rnds.	100 rnds.	200 rnds.	
440	The parts of the series printed in large figures represent the effective dangerous zones, in which 10 or more hits are counted on each screen.
450	..	..	..	1	..	1
460	..	..	..	4	..	4
470	1	..	1	4	..	4	
480	4	..	4	4	..	4	
490	4	..	4	11	..	11	
500	4	..	4	17	..	17	
510	11	..	11	21	..	21	
520	17	..	17	23	..	23	
530	21	..	21	25	..	25	
540	23	..	23	35	..	35	
550	25	..	25	49	..	49	
560	35	..	35	48	..	48	
570	49	..	49	49	..	49	
580	48	..	48	52	3	55	
590	49	..	49	51	4	55	
600	52	3	55	47	6	53	
610	51	4	55	34	7	41	
620	47	6	53	31	14	45	
630	34	7	41	24	15	39	
640	31	14	45	24	19	43	
650	24	15	39	16	26	42	
660	24	19	43	11	26	37	
670	16	26	42	5	29	34	
680	11	26	37	3	35	38	
690	5	29	34	..	28	28	
700	3	35	38	1	33	34	
710	..	28	28	2	32	34	
720	1	33	34	2	26	28	
730	2	32	34	2	29	31	
740	2	26	28	1	17	18	
750	2	29	31	..	13	13	
760	1	17	18	..	6	6	
770	..	13	13	..	3	3	
780	..	6	6	..	4	4	
790	..	3	3	..	5	5	
800	..	4	4	..	4	4	
810	..	5	5	..	4	4	
820	..	4	4	..	3	3	
830	..	4	4	..	2	2	
840	..	3	3	..	2	2	
850	..	2	2	..	..	..
860	..	2	2	..	..	..
870	..	..	..	..	..	..

“A.”

The men fired lying down with their rifles supported on a rest. Targets 20 metres wide, 1·80 metres high.

Targets in front of nucleus, distances in metres.													Nucleus or mean centre of impact.	Targets in rear of nucleus, distances in metres.																				
130	120	110	100	90	80	70	60	50	40	30	20	10		10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210
Number of hits excluding ricochets.																																		
12	14	15	18	24	26	30	44	53	60	64	70	68	71	61	61	57	36	29	21	16	9	8	4	5	5	6	6	5	4	3	3	2	2	1
14	16	24	24	31	44	55	62	66	74	73	79	77	77	68	66	57	37	31	22	17	12	11	5	7	7	6	6	6	4	3	4	2	2	1
4	6	6	7	9	19	25	30	30	36	41	51	56	64	58	50	44	37	27	17	13	14	13	14	14	13	8	7	4	3					
6	7	9	19	25	30	34	39	45	51	60	69	71	68	59	52	47	39	33	23	16	15	16	17	17	13	8	7	4	3					
1	4	4	4	11	17	21	23	25	35	49	48	49	52	51	47	34	31	24	24	16	11	5	3		1	2	2	2	1					
4	4	10	16	22	21	27	37	45	56	63	62	56	62	64	52	42	37	29	25	16	11	5	4		2	2	2	2	1					
			3	4	6	7	14	15	19	26	26	29	35	28	33	32	26	29	17	13	6	3	4		5	4	4	3	2	2				
			5	7	14	16	20	26	33	36	39	42	45	40	39	41	32	30	18	15	10	7	6		6	6	5	3	2	2				
		3	3	4	4	9	12	13	15	19	24	24	31	27	29	23	19	14	8	5	3	1	2		1	1								
		5	5	6	11	14	13	23	25	29	37	40	42	41	39	31	21	17	9	6	4	2	2		1	1								
		1	1	.	.	.	1	6	10	12	14	24	31	28	23	22	19	13	7	5	6	5	3		1	2								
		1	2	2	3	4	6	10	16	26	34	38	42	38	29	25	23	14	11	7	7	6	4		2	2								
		3	2	3	4	3	4	13	18	14	9	15	27	26	13	5	7	9	10	3	1													
1	3	5	5	4	6	8	18	24	26	20	27	38	42	31	17	11	18	15	11	4	1													
			1	3	4	4	6	11	13	9	7	17	18	17	14	12	15	11	5	2	.		2	1										
			4	6	8	11	13	12	17	14	19	24	29	29	23	25	20	15	6	3	2	2	1											
			2	3	.	1	2	2	6	12	13	15	22	14	10	6	7	2	.	1	2	2	1		1									
			3	3	1	3	5	11	19	24	31	34	35	22	15	12	9	3	2	3	3	3	2		1									
			3	2	2	1	5	4	6	10	8	8	14	7	10	8	6	3	2	.	1	1												
			5	4	5	7	11	12	18	18	32	19	22	17	19	12	11	5	2	2	3	1												
		1	.	.	3	2	4	4	2	3	8	10	11	10	9	17	9	4	.		1													
		1	1	3	5	8	7	6	5	11	21	26	22	24	25	25	13	4	1	1														

“B.”

Targets 20 metres wide, 0·45 metre high.

[illegible]

Ex.—100 m. = $100 + \frac{100}{10} = 110$ yds.
Ex.—100 yds. = $100 - \frac{100}{10} = 90$ m.

"A."

Distances of the targets from the men firing in metres.

Number of hits excluding ricochets.

NUMBER OF MEN'S BREADTHS (0.40 m.) HIT ON A TARGET THE HEIGHT OF A MAN (1.80 m.), AND (20 m.) OR 50 MEN'S BREADTHS
(All hits on the same man's breadth counting as one hit.)

[illegible]Distances of the targets from the firing point in metres.

N.B.—To turn metres into yards add one-tenth. Ex.—100 m. = $100 + \frac{100}{10} = 110$ yds.
To turn yards into metres deduct one-tenth. Ex.—100 yds. = $100 - \frac{100}{10} = 90$ m.

Table 18.

Series with a combination of three sights.

Distances. Metres.	1100 m. sight.	1200 m. sight.	1300 m. sight.	Combined 1100, 1200, 1300 m. sights.	Combined 1100, 1200, 1300 m. sights.	Remarks.
100 rounds.	100 rounds.	100 rounds.	100 rounds.	300 rounds.	600 rounds.	
990	Each screen receiving 10 or more hits has its record printed in large figures.
1000	1	..	..	1	2
1010	3	..	..	3	6
1020	4	..	..	4	8
1030	4	..	..	4	8
1040	6	..	..	6	12
1050	11	..	..	11	22
1060	13	..	..	13	26
1070	9	..	..	9	18
1080	7	..	..	7	14
1090	17	..	..	17	34
1100	18	2	..	20	40	
1110	17	3	..	20	40	
1120	14	..	..	14	28
1130	12	1	..	13	26	
1140	15	2	..	17	34	
1150	11	2	..	13	26	
1160	5	6	..	11	22	
1170	2	12	..	14	28	
1180	..	13	..	13	26	
1190	2	15	..	17	34	
1200	1	22	3	25	50	
1210	..	14	2	16	32	
1220	..	10	2	12	24	
1230	..	6	1	7	14	
1240	..	7	5	12	24	
1250	..	2	4	6	12	
1260	..	..	6	6	12
1270	..	1	10	11	22	
1280	..	2	8	10	20	
1290	..	2	8	10	20	
1300	..	1	14	15	30	
1310	..	1	7	8	16	
1320	..	..	10	10	20
1330	..	..	8	8	16
1340	..	..	6	6	12
1350	..	..	3	3	6
1360	..	..	2	2	4
1370	..	..	..	..	..
1380	..	..	1	1	2
1390	..	..	1	1	2
1400	..	..	..	..	..

Table 19.

Percentage of hits with one sight and with two ; the distance unknown, and the series not displaced by atmospheric influence.

Real distances. Metres.	Percentage with the--		Remarks.
	600 m. sight.	Combined 600 and 700 m. sights. ¹	
570	49	24·5	It is assumed that the distance has been judged to be 650 m.: the mean error in judging being $\frac{1}{7}$ of the real distance, this may vary between $\frac{650 \times 7}{6}$ and $\frac{650 \times 7}{8}$, that is between 760 and 570 m.
580	52	27·5	
590	51	27·5	
600	47	26·5	
610	34	20·5	
620	31	22·5	It must not be forgotten that the depth of the effective dangerous ground, resulting from the fire of 200 rounds with the combined sights of 600 and 700 m., is 280 m.; while it is only 180 m. with the single 600-m. sight and the same consumption of ammunition.
630	24	19·5	
640	24	21·5	
650	16	21	
660	11	18·5	
670	5	17	
680	3	19	
690	..	14	
700	2	17	
710	1	17	
720	2	14	
730	2	15·5	
740	1	9	
750	..	6·5	
760	..	3	
Total....	355	361·5	
Mean per cent.	17·75	18·07	

¹ The terms of the series have been taken from Table 17; the terms depending on the combination of two sights have been divided by two, to bring them into correspondence with an expenditure of 100 rounds with the single sight.

Table 20.

The vertical axes and the ordinates of the 1600 m. gerbe in collective firing.							
Distances.	Extreme vertical dispersion due to differences in 10 samples of the Mauser rifle of recent manufacture.	Vertical axes of the shot groups in individual fire.	Total vertical dispersion due to the rifle.	Vertical dispersion resulting from errors in aiming of 30 minutes.	Vertical axes of the shot groups of the Mauser rifle in collective fire.	Ordinates of the mean trajectory of the 1600 m. sight.	
						Upper trajectory of the 1600 m. gerbe.	Lower trajectory of the 1600 m. gerbe.
Metres.	Metres.	Metres.	Metres.	Metres.	Metres.	Metres.	Metres.
400	1.33	0.84	2.17	3.49	5.66	46.40	40.74
500	1.66	1.18	2.84	4.36	7.20	55.34	48.14
600	2.00	1.58	3.58	5.23	8.81	62.84	54.02
700	2.33	2.12	4.45	6.11	10.56	68.72	58.16
800	2.66	2.80	5.40	6.98	12.44	72.79	60.35
900	3.00	3.78	6.78	7.85	14.63	74.93	60.31
1000	3.33	4.74	8.07	8.73	16.80	74.79	57.99
1100	3.66	6.06	9.72	9.60	19.32	72.34	53.02
1200	4.00	7.60	11.60	10.47	22.07	67.32	45.26
1300	4.33	9.64	13.97	11.34	25.31	59.68	34.98
1400	4.66	12.12	16.78	12.22	29.00	49.19	20.19
1500	5.00	15.12	20.12	13.09	33.21	35.68	2.48
1600	5.33	18.72	24.05	13.96	38.01	19.00	-19.00

Table 21.

Comparison between the depth of the dangerous ground as obtained by calculation and from experimental firing.

Distances.	Vertical axis of the shot groups of the Mauser rifle in collective fire.	Tangents of angles of drop.	Depth of the ground struck by all the bullets in the gerbe. ¹	Theoretical dangerous zone in individual firing.	Depth of the dangerous ground as obtained	
					From calculation.	From experimental firing, <i>vide</i> Table 14.
Metres.	Metres.	Metres.	Metres.	Metres.	Metres.	Metres.
500	7.20	.02910	240	65	305	300
600	8.21	.03783	232	48	280	290
700	10.56	.04949	213	38	251	260
800	12.44	.06116	203	32	235	230
900	14.63	.07578	193	25	218	220
1000	16.80	.09042	185	20	205	200
1100	19.32	.10510	183	17	200	200
1200	22.07	.12278	179	15	194	210
1300	25.31	.14351	177	13	190	190
1400	29.00	.16435	176	13	188	180
				Totals	2266	2280
				Means	226.6	228

$$^1 \text{ Ground struck} = \frac{\text{Height of shot group}}{\text{Tangent of angle of drop}}$$

Table 22.

Reduction in the normal interval of 10 m. between the screens, due to the ground on which the bullets fall not being parallel to the line of sight.

Sights.	Normal angle of drop.	Tangent of the normal angle of drop.	Tangent of the actual angle of drop when the ground on which the bullets fall, rises with reference to the prolongation of the line of sight.			Reduction in length of the normal 10-m. interval between the screens, when the ground on which the bullets fall, rises with reference to the prolongation of the line of sight		
			3°	5°	10°	3°	5°	10°
Metres.	° 1 10 1 40 2 10 2 50 3 30 4 20 5 10 6 00 7 00 8 10 9 20 10 30 11 50					Metres. 3·0 3·5 4·0 4·8 5·0 5·8 6·3 6·6 6·9 7·2 7·5 7·8 8·0	Metres. 2·0 2·4 3·0 3·5 4·1 4·6 5·1 5·4 5·7 6·1 6·4 6·5 7·3	Metres. 1·1 1·4 1·7 2·1 2·5 2·9 3·6 3·7 4·0 4·3 4·6 4·9 5·2
400	1 10	·02037	·07286	·10805	·19740			
500	1 40	·02910	·08163	·11688	·20648			
600	2 10	·03783	·09042	·12574	·21560			
700	2 50	·04949	·10216	·13758	·22781			
800	3 30	·06116	·11394	·14945	·24008			
900	4 20	·07578	·12869	·16435	·25552			
1000	5 10	·09042	·14351	·17633	·27107			
1100	6 00	·10510	·15838	·19436	·28675			
1200	7 00	·12278	·17635	·21256	·30573			
1300	8 10	·14351	·19740	·23393	·32814			
1400	9 20	·16435	·21864	·25552	·35085			
1500	10 30	·18534	·24008	·27732	·37280			
1600	11 50	·20952	·26483	·28360	·41040			

Table 23.

Comparison between the extent of the effective dangerous ground when the bullets fall on a surface parallel to the line of sight, or on one inclined to it.

Sights.	Number of rounds.	Depth of the effective dangerous ground			
		When the bullets fall on a surface parallel to the line of sight.	When the bullets fall on a surface which makes with the line of sight an angle of—		
			+ 3°	+ 5°	+ 10°
Metres.	Metres.	Metres.	Metres.	Metres.	Metres.
400	100	210	63	42	23·1
500	100	200	75·5	50·4	29·4
600	100	170	68	51	28·9
700	100	130	62·4	43·5	27·3
800	100	110	55	45·1	27·5
900	200	140	81·2	64·4	40·6
1000	200	110	69·3	56·1	39·6
1100	200	120	79·2	64·8	44·4
1200	200	80	55·2	45·6	32
1300	300	100	72	61	43
1400	300	110	82·5	70·4	50
	Totals ..	1480	761·3	594·3	386·4
	Means ..	134	70	54	35

NOTES ON THE FRENCH ARMY.

IN the French military periodical "L'Avenir Militaire" have lately appeared a series of editorial articles on the present condition of the field training of the French Army as shown at the autumn manœuvres. The articles are written in an apparently impartial spirit, and they give the results of an examination of testimony furnished from various sources, on matters concerning which the opinions of the observers appear to be, practically, unanimous. The verdict arrived at is as follows :—

On the whole the French Army has for several years made undoubted progress, but the progress has been slow. The upholders of the new tactics have had to struggle against routine. Far too many of the General Officers remain attached to the old system of warfare, and refuse to acknowledge the urgent character of the modifications rendered necessary by the modern improvements, not only in artillery, but also in infantry weapons. This tendency to remain *in statu quo* is most regrettable. It leads to hesitation in the subordinate ranks, and paralyzes the efforts of those who look forward and foresee the future.

Staff.—The work of the staff generally has been well done. The "ideas" for the operations have been judiciously selected, suited to the nature and form of the ground on which they were to be carried out, and to the time at disposal for their execution. The written orders were clear, and the respective situations of the opposing forces well described. But they were not always thoroughly understood, and the lower in the scale of command, the less precise they became. Some commanders, especially, extended their battalions to a degree quite out of keeping with the original "idea," and indicated besides only in a vague way the lines of direction, the points to be occupied, and the zone of action of each tactical unit. It is a known fact that in actual warfare the carrying out of orders most clearly laid down is exposed to many unforeseen hindrances, but when the commanding Officer of a battalion, for instance, receives himself, as a starting point, indefinite instructions, the state of indecision in which he is thrown necessarily communicates itself to the Captains acting under his directions. This was remarked in more than one instance. A tactical operation thus undertaken without a thoroughly defined object is nearly always a failure. If it succeeds, the result is due to chance, or to some serious fault committed by the opponent. It must be borne in mind also that the orders of the superior authorities arrived in the course of the evening in time to be communicated to the various commanding Officers and commanders of battalions before night. In previous years this was not always the case.

Infantry.—Infantry is the arm which suffers most fatigue in the manœuvres. It has had to carry out this year long and trying marches, especially in the East, in the regiments of the 7th and 8th Corps. The fatigue has been borne cheerfully. There have been but few sick. However, the knapsacks were far from being properly packed as on active service, a most regrettable proceeding, leading to illusions being created from which the awakening will later on be fatal. It is absolutely necessary that next year General Officers take this matter in hand, so as to insure the kit weighing during the manœuvres as much, or nearly as much as they do on service. It is the only way to judge whether the weight on service should be reduced, or the men trained by progressive exercises to carry this weight for at least fifteen

successive days at the manoeuvres. The marches have, however, been well performed this year, and marked progress has been shown not only in marching power, but in the maintenance of order and discipline in the columns. As much cannot be said of the marches considered from the technical point of view, especially as regards measures of security. Infantry columns moved along the roads in close proximity to the enemy just as if he were several days' march away. There was no waiting for intelligence from cavalry scouts, patrols, or flankers, who, it may be observed, were far too reticent in the matter. It occasionally happened that a report from a flanking patrol to a commanding Officer to the effect that he could pass without fear a wood, a village, &c., reached him a quarter of an hour after he had gone by the point of danger. In warfare this inversion of the proper mode of proceeding must be avoided. To arrive at a point quickly is good, but to arrive there in safety is better; and to arrive quickly, exposure to falling by precipitate action into an ambuscade must be avoided. Outpost duties were well done when ordered, but outposts were not always placed before the cantonments, even when in presence of the enemy. There seemed to be some dislike to making troops bivouac for the purpose. The Officers and soldiers must, however, learn to undergo the fatigues of the duty. Wilful neglect of this kind during peace manoeuvres may lead to false ideas being formed by men and commanders alike as to their duties of this nature in war. It is greatly in this direction that we sinned in 1870-71.

In the combat, the infantry showed itself possessed of high qualities as regards rapidity of movement. No obstacle seemed to be able to damp their *élan*. They showed less ability in taking advantage of ground and cover, but this was the fault rather of the leaders, and especially of the junior Officers. Whilst it would be imprudent to instil into the infantry, principles contrary to the French spirit of initiative and dash, it would be absurd altogether to neglect the use of cover. The artillery preparation for the attack has generally been insufficient, but even if it be true that it is useless at manoeuvres to prolong the duration of this fire, it is equally desirable that on all, and especially on the Officers, should be impressed the actual facts of a combat, and the danger of a premature attack. The final assaults were carried out with great vigour, and this was done at the conclusion of long marches, and of advances over difficult ground.

As regards the conduct of the work by the Officers, the front occupied was out of all proportion to the number of men—in one case a corps holding a line by a force in the proportion of one man to two mètres—the infantry fire was badly regulated and directed, the object being apparently to retain sufficient cartridges to the end of the manoeuvres; fire was also uselessly thrown away, and the defenders held out either an absurdly long time, or retired precipitately.

Cavalry.—The cavalry, except in the 7th and 8th Corps, utterly failed in reconnoitring duties. The French cavalry is not sufficiently exercised in connection with the other arms, especially with the infantry. They seem more at home with the artillery, but manoeuvres of cavalry and artillery together teach the former nothing of their other duties. Still the cavalry has made great progress in the last five or six years. The marching was well regulated, and horses and men were on good terms with each other; the equipment is bad and heavy, and requires immediate reform.

Artillery and Engineers.—The former worked admirably, and showed themselves possessed of great mobility; the positions they took up were well chosen. The engineers did their work also satisfactorily. To sum up, the army is progressing, but it might progress faster.

The reserve men have in all respects done their work well, as have those Sub-lieutenants, Officers of the reserve who were originally non-commissioned officers, but of those Sub-lieutenants who were originally Officers, many

seemed to have lost their military habits, and not to have practice enough even to command a section. Unfortunately there has been occasion to remark that the relations between the senior and junior ranks seem to fail in that feeling of mutual respect which is so essential in an army.

The same paper gives, from a German source, the following criticisms dealing mainly with the cavalry. Decided progress has been made; notwithstanding the absence of all regular system in the general reorganization of the army and the irremediable precariousness of tenure of office by the Ministers of War, the instruction of the troops has improved, and more and more marked are the efforts of the Officers to increase their knowledge of their profession, and to study the weaknesses inherent in the nature of the men they command. Many years must pass, however, before the French cavalry can more approximately fulfil the requirements indicated by the late General v. Schmidt. Time is necessary to remedy the weak point, the remounts. But few regiments could muster the regulation number of 100 per squadron, the stables being full of young horses under five years old, of which there are 250 with each regiment. These regiments are not, therefore, ready for war, and there are such difficulties in the garrisons in the way of tactical instruction that the regiments are not sufficiently prepared to enable them to act in large masses of cavalry. A notable portion of the Officers of the higher grades are physically unfit to bear the fatigues of this kind of work; other Officers do not bear in mind the difference between the powers of the horses they ride themselves, and of those on which the men they lead are mounted; the guides and the men are not, therefore, well in hand. But there is evident improvement, both in the care bestowed on the horses and in the riding. Although this progress is limited to a few Officers, its value in increasing the general efficiency of this arm is very great. But the education of the cavalry Officer being the work of years, the concentration of six divisions of cavalry in time of peace is one of those exaggerations from which the French suffer. Years will be necessary for the formation of the groundwork of the employment of cavalry in large masses.

Every army has its own special qualities and its own special faults. Slackness of discipline and an unconquerable tendency to evade service regulations is the particular fault of the French Army. The fault exists no less under the Republic than it did under Napoleon III. For instance, it is no uncommon practice for cavalry Officers either not to keep the regulation number of chargers, or else not to bring them out at the manœuvres, not minding to appear there on the inferior horses. The practice is well known to, and is tolerated by the authorities. The action of the authorities in this respect seems to be in keeping with a recent order of the Minister of War on the wearing plain clothes, "because the conditions of daily life, particularly in large towns, continually oblige superior Officers to shut their eyes to disobedience of orders." The question of the necessity of the wearing uniform or plain clothes is one thing, but to give as the reason for withdrawing an order that the order is not obeyed is to subvert all principles of discipline. It must never be forgotten that the French Army is not only a military institution; it is also a political organ; and now that the Republic is mistress of the situation, and without much fear of competitors for power, the army is at a discount. At every crisis the ultimate decision rests with the army, and this influence is decisive on the spirit of all the military institutions of France.

Moreover, in an article which appeared in the November number of the "19th Century," by Captain Norman, entitled the "French Army of To-day," there is not only ample confirmation of the disturbing influence of politics on the army generally, but we find cogent reasons for believing that, as a military machine, the army of France is far below the standard of efficiency at which a Continental Power must maintain its armed forces if it aspires to any voice in the council of nations. Captain Norman remarks that just as the campaign of

1866 caused Europe to arm itself with the breech-loader, so did that of 1870 give rise to the demand for army reserves. "The ceaseless stream of well-trained men which enabled Germany to present veteran battalions at every point against the raw recruits France hurled against her, created a cry for universal service, for a territorial army, for enormous armaments; and so in 1872 the new French military organization first saw the light." Captain Norman is of opinion that the result attendant on army reform in France may be stated as follows:—"Skeleton battalions, untrained reserves, slack discipline, difficulty in obtaining good non-commissioned officers, and the zeal of the commissioned ranks deadened by slow promotion."

Without either questioning or accepting the accuracy of the figures given by Captain Norman, there is little doubt that the unsatisfactory condition of the French Army as set forth by him is substantially correct. Liability to military service in France is fixed at twenty years, the first five of which are with the colours; the next four are in the reserve of the active army; the next five are in the territorial army; and the last six in the territorial reserves. As the system has been at work only since 1872, the territorial reserve, which comprises all those men between the ages of 34 and 40, and three classes of the territorial army comprising all those between the ages of 31 and 34, have not yet received any contributions from the active army, and if they exist at all are formed of men who have not passed through the ranks. The army formed since 1872 comprises some 3,000,000 of men, but of these the larger moiety is absolutely untrained, and only about one quarter have served even three years in the ranks. The period of service with the colours was originally fixed at five years, avowedly on the ground that the national character of the Frenchman rendered him more difficult to train as a soldier than the less volatile and more submissive German on the other side of the Rhine. It has been found, however, impossible in practice to adhere to the five years' system in the infantry, and he is generally released at the end of three years. The army is also very weak in Officers, being some 14,000 short of the number required to place the active army and its reserve on a war footing. The territorial army is far below its strength both in Officers and men, 12,000 of the former, and 261,000 of the latter being required to bring it up to full strength, and little has apparently been done in the direction of forming the territorial reserves. Politics are more than ever a factor which enters into questions of promotion among the Officers, and the difficulty experienced in all armies in obtaining good non-commissioned officers is keenly felt. Very young soldiers soon attain the rank of non-commissioned officers, and become invested with powers of punishment equal to those possessed by Officers commanding companies in the British Service, and this before they have themselves learned to obey. Discipline throughout the army is at a low ebb.

The condition of the French Army just now, judging from the foregoing remarks, is such as to render it harmless to Germany, and considering the divided interests which are actively at work, not only in the army itself, but also in its administration, it is difficult to see whence can arise the influence which shall combine the discordant forces in forming an effective instrument for national defence. A hotel keeper at Le Mans, talking to some English Officers, and lamenting the state of the French Army, probably went very close to the truth when contrasting English and French Officers; he said: "All you gentlemen have one object in common, the good of your country; in our army we are each of us for the good of our own party."

L. A. H.

A PRUSSIAN CRITICISM ON THE AUSTRIAN CAVALRY MANŒUVRES OF 1883.

(From the "Vedette" of the 14th October, 1883. Translated by Captain
HARE, R.E., D.A.Q.M.G.)

It may be interesting to our readers to hear the remarks of the Special Correspondent of the "Kölnische Zeitung" on our manœuvres at Brück on the Leitha; he says:

At the first of the two manœuvre exercises held on the 25th September, the Cavalry Division was ordered to advance against a skeleton or marked Division of similar strength placed between Pachfurt and Neudorf, and this movement was interesting inasmuch as a great many ditches had to be crossed, some being what might be called rather ugly. They were, it is true, hardly of such a character as to stop the general advance, but still it might have been reasonably expected that a good many riders would have come to grief, especially when, towards the end of the movement, the ditches would have had to be negotiated at a pretty stiff pace. I rode over the ground before the movement, and afterwards saw the Division clear the obstacles. Contrary to all my expectations, not a single horse came down, which speaks wonders for the good riding of the Austrian cavalry. Nor was there any checking or rushing to be seen, nor indeed any confusion whatever, and any one not being quite close would never have noticed the existence of so many obstacles. As regards the general arrangement of the attack, which took place as usual in successive lines (*Treffen*), the only facts worth noticing are the formation used was that much preferred in the Austrian Service, that is, the double column (very like the Prussian column on the two centre squadrons, or the *Kolonne aus der Mitte*), and the successive lines kept their time and distance perfectly. One regiment did a thing which is rarely done at manœuvres, or, indeed, at any other time, that is, it caught a skeleton regiment of the marked Division, which was attempting to form up as a third line behind the first two, so quickly and suddenly that it had no time to show front. The attack, in fact, fell partly on the head and partly on the flank of the column on the move, and in real war would have practically destroyed it. The regiment that performed this feat managed to get close up to the enemy behind the spur of a hill, and then waiting for an opportunity, when he was in the most unfavourable position for defence, charged home with dash and determination.

There are few opportunities at manœuvres against a skeleton enemy for bold surprises, but this, as a fact, was one.

As regards the artillery advance, which was faultless, as it always is in the Austrian Service, fire was opened at the enormous range of 2,400 mètres, and the guns were generally kept at this range throughout the whole movement. Only quite at the end was a battery ordered to close with the enemy, but before its action could be properly appreciated, the exercise came to an end.

The second exercise which then followed necessitated a fresh formation and a totally different system of fighting. The Cavalry Division was supposed to be on the right flank of an army corps engaged with the enemy, and had received the order to attack the left flank of the enemy's infantry. This was the first time during this year's manœuvres that cavalry was employed against infantry, and when we think for a moment how often in real war

cavalry must reckon on having to deal with infantry, though perhaps not to attack it at all times and places, the idea of introducing the infantry element into the exercise must certainly be considered a happy one. If Cavalry Divisions are to be "independent," that is to say, are to be equal to undertaking wide sweeping movements, it must never be forgotten that they are sure to fall in with infantry. Of course, if they come across large masses of infantry they can do little or nothing, and their further advance is either stopped altogether or they must adopt some other plan of gaining the object in view. But if the opposing infantry is weak, cavalry must be prepared, with the help of artillery, to crush the resistance offered, either by charging home sword in hand or by dismounting and fighting on foot; and the latter system of fighting appears to be little practised in the Austrian cavalry. Perhaps they are wrong. The fact that cavalry Divisions must constantly in war come across infantry in small bodies would appear to point to the desirability of attaching a battalion of infantry (and what is the particular use of *Jägers*?) to each Division of cavalry, which might, by the direction of the Officer commanding the latter, be used now in one place and now in another, but always so that its whereabouts were unknown to the enemy. Infantry might often have thus been employed at Brück, as there happened to be a battalion in the camp there. But, as a fact, it was only employed once, and then to represent a skeleton enemy, the battalion being taken to represent two whole regiments. Any speculations as to what might be considered success or failure at manœuvres such as these with a skeleton enemy—unless, indeed, the case be quite a special one, as in the first exercise—cannot be otherwise than extremely vague. On the other hand, one point was very remarkable, and that was the cavalry appeared to come up so fresh, in spite of the previous calls that had been made on it, that it certainly had a very fair chance of success. The exercise, which must have taken a good deal out of horse and man, came to a close immediately after these attacks, and it certainly left a most favourable impression, both on account of the excellent riding of the men as well as on the hard condition of the horses.

To form anything like a real and general opinion of the fighting value of the Austrian cavalry, it must be considered under two distinct heads, viz., first, its strength or numbers and the material of which it is made, and, secondly, its training. Now, as regards numbers, the Austrian Army is even more than amply provided with cavalry. There are, it is true, only forty-one regiments of cavalry, but these consist of six squadrons each, all prepared to take the field in case of mobilization, whereas, it is well known, one of the five squadrons of a German cavalry regiment remains at home, to act as a dépôt, and consequently must not be reckoned on for war. The Austrian cavalry would, in fact, with its forty-one regiments, put as many squadrons in the field as $61\frac{1}{2}$ German regiments, of which there are altogether only 93. And as, moreover, provision is made for rapidly establishing reserve formations, the Austrian cavalry hardly leaves anything to be desired as regards numbers. The supply of horses in Austria proper and Hungary, and especially in the latter, more than amply covers all home requirements; indeed, there is plenty of room for exportation to other countries, France and Italy, it is well known, being considerable purchasers in the Austro-Hungarian market. This fact alone shows that the Austro-Hungarian animal must be a desirable cavalry horse. A German and Austrian cavalry regiment, if put alongside each other, would, as a matter of fact, be about equally well mounted. As regards arms and equipment, the usual rule is followed, that is to say, dragoons and hussars have swords and carbines, and lancers lances and revolvers. In the latter, forty-eight men per squadron carry a carbine instead of the lance, a far better plan than encumbering the man with both, as is done in some countries. The Russian plan is somewhat similar, but is the same for all cavalry, the only difference being that the front rank carry lances and the rear rank carbines.

The Austrian lances, it may be noticed, are without lance-flags, a fashion that, at any rate, it would be undesirable to copy, as it looks anything but pretty. I am glad to say I cannot draw pictures of the Austrian cuirassiers; these have been long ago abolished in Austria, whereas we are still hanging back in Germany at this step. The Austrian cavalry soldier's uniform is simple, and, with the exception of the dragoon's huge helmet, neat enough; the red forage-cap is especially so and gives the man a smart appearance. The red overalls, worn tucked in in knee-boots, are strange to the German eye, but wear better than might be at first supposed from such a bad colour, though unprovided with any kind of leather strapping. The officers' uniform is similar to the soldiers'; the various blouse-like jackets worn off duty are, however, too plain, and prevent the rank being easily recognized, a circumstance that many Austrian Officers are quite ready to admit.

Coming now to the question of training, let us first deal with the Officers. The Austrian cavalry has long and glorious traditions, a matter of immediate importance to the Officers of any arm. Austrian cavalry Officers have always had the reputation of being excellent riders, and, as far as I was personally able to judge, they fully keep this reputation up. Both seat and hands are faultless, and the horses are seen at a glance to be thoroughly broken. The greatest attention is paid in Austria to the training of cavalry Officers, and it is certainly of a very exacting nature. Every young Officer must, before he is appointed to a regiment, have passed eight months at a brigade school, where he is simply trained, first as a rider, and next as a coming riding-master. These young gentlemen have, besides the usual school instruction, to ride from six to eight horses a day, and are not only, as with us Germans, encouraged to ride across country, steeplechases, &c., but are ordered and actually taken out to do so without being asked. In this the greatest attention is paid to jumping, and it is hardly necessary to add, the excellent jumping of the men, which is so remarkable, cannot be otherwise than due to the still more excellent jumping of the Officers. As with the Officers so with the men, seat and hands are all that can be desired, and a bad rider is a very rare sight indeed. The men have, both when mounted and dismounted, a light, smart, and soldier-like appearance. School-riding seems to be very well understood, for the horses are well-balanced and willing, and are ridden up to the bit without persuasion. I have not, curiously enough, seen a single refusing horse, a fact that must be only taken to show that there are fewer of such brutes in Austria than in other countries.

At the exercises above alluded to were to be seen the movements of large masses, and consequently the usual deployment for the charge of the brigade and Division. Without going into the details of the Austrian cavalry field exercise, it may perhaps be noticed that the Austrian cavalry pay particular attention to simplicity of formation, and, as far as possible, use the double column (a formation formerly used in Germany, the *Kolonne aus der Mitte*), placing sometimes two regiments and sometimes the two divisions of a regiment (three squadrons each) alongside each other. The *Zugkolonne* (or column of quarter-squadrons, is also frequently used, but the *Halbkolonne*, or column of half-squadrons, so much used in Germany, never. Where the Austrian cavalry differs so much from the German is in the pace; both canter and trot (the former about 60 mètres to the minute) are much slower in the Austrian than in the German service, and of course this in actual warfare means being longer under fire. On the other hand, the slower pace has the advantage of greater order and regularity, and such a thing as a horse half breaking away and getting out of hand at the charge is very rarely to be seen. The Austrian plan of a slower trot than the German may be a sound one; at any rate, even among German cavalry Officers opinions are certainly divided on the question. The trot is a pace that has to be kept up for a long time, and is never used for the actual charge, and should consequently, even when kept up for half-an-

hour or more without a check, not take it out of the horses. With the regulation trot of the German cavalry, horses soon show signs of sweating and distress. The looser riding of the Austrian cavalry has perhaps something to say to the pace being slower.

And now for a word on the system of cavalry manœuvres carried out at Brück. The first thing that strikes one is the great use made of a marked or skeleton enemy, and together with it the system of two manœuvres on the same day. This is generally considered in Austria as necessary for the training of the commanding Officers.

There is no question but that the general arrangements of the manœuvres were such as enabled both troops and Generals to learn a great deal; the mere looker-on can say that the Austrian cavalry showed a very high state of training in carrying them out, and is fully up to the mark of the cavalry of a great Military Power. To judge troops of different States according to some fixed pattern or standard is a matter of impossibility and should never be attempted. Faults on one point or another can always be found, but these, when compared perhaps with other conspicuous merits, are found to vanish. This is certainly the case with the Austrian cavalry, and to form a general opinion otherwise than a very favourable one of its value, would be difficult indeed.

REORGANIZATION OF THE AUSTRIAN INFANTRY.

By Lieutenant ROSS OF BLADENSBURG, A.D.C., Coldstream Guards.

THE system introduced by the recent reorganization of the Austrian Infantry received the Imperial sanction on the 30th November 1882; it was published in a General Order two days later, and was brought into force on the 1st January 1883.

Under this new regulation the Austrian Infantry is divided as heretofore into infantry of the line and into a rifle corps (*Jäger Truppe*). The total number of service battalions composing these two forces remains the same as formerly, but eight battalions belonging to the rifles have been absorbed into infantry of the line.

There used to be 80 infantry regiments, each composed of three field, two reserve, and one depôt battalion. The first five named battalions had four companies each, but the depôt had five, and under pressure it could be expanded into a sixth battalion of four companies, leaving in the recruiting district a small nucleus of one company to carry on the work at the depôt. It would be more proper to say that each infantry regiment was in reality composed of two regiments having a common depôt, viz., the field regiment of three, and the reserve regiment of two battalions. These two portions were practically independent of each other: they had different establishments; in peace time they were not liable to serve in the same district, and during a war they seldom formed part of the same infantry division.

Under the present system, introduced in 1883, there are 102 regiments constituted, each composed of four field and one Ersatz battalion. The new regiments have been made up by a partial dissolution of those which were in existence and by the incorporation of such rifle battalions as have been converted into infantry battalions.

Thus, where formerly the infantry of the line numbered 400 field and 80 depôt battalions, now there are 408 field and 102 Ersatz battalions. A still further increase is made by the provision of what is termed "Staff Infantry," which will be noticed further on.

The Austro-Hungarian Empire was divided into 84 recruiting districts: one for every infantry regiment, one (viz., Tyrol and Vorarlberg) for the Tyrolese rifle regiment, and three for the navy. The rest of the army was recruited from these districts in a manner laid down in the "Official Instructions for carrying out the Law of Military Service."¹ The same system still prevails, and every new infantry regiment has a district assigned to it, while the Tyrolese rifle regiment recruits from Tyrol and Vorarlberg as heretofore. A redistribution of recruiting districts has taken place, in consequence of the present change in infantry reorganization, and the remaining portions of the army will receive their quota of young soldiers from such infantry districts as are allotted to them.

The new infantry regiment is formed of the regimental staff—including the Officers and men belonging to the headquarters of the regiment and of the field battalions—and of 16 companies, numbered consecutively throughout the regiment, four to each battalion. The company may therefore be taken as the new basis upon which the strength of the regiment is constructed. In peace time the regimental staff is composed of 16 Officers and 68 men, of

¹ "Instruktion zur Ausführung des Wehrgesetzes."

which ten of the former and five of the latter are combatant, the remainder being reckoned non-combatant.¹

The company on a peace footing is fixed at three establishments, viz., the normal, the increased, and the diminished strength. The first of these includes 86 men, all told (82 combatant)—3 Officers, 1 cadet, 13 non-commissioned officers, and 69 privates. The increased formation contains 131 men (127 combatant)—3 Officers, 1 cadet, 22 non-commissioned officers, and 105 privates. The diminished establishment contains 71 men (67 combatant)—3 Officers, 1 cadet, 12 non-commissioned officers, and 55 privates.²

The company's normal formation is that ordinarily adopted, and it is only under special circumstances that the companies of a field battalion can be raised to the increased establishment. When this is done for one battalion of a regiment the remaining three are by the regulations put upon the diminished formation; to effect this, the men are transferred from one battalion to the other, and the necessary non-commissioned officers are called up from furlough.

The regiment has but five horses borne upon its strength in peace time, all of which belong to the regimental staff. It will be seen that during a war the Captains of companies are mounted, and it is perhaps worth remarking that such Officers who have to command from on horseback are not obliged to ride during their ordinary training. It is possible, however, that they are mounted during manœuvres, or when large bodies are massed together for drill.

Taking the companies upon their normal establishment, the regimental staff and the four field battalions are composed of 64 Officers and 1,396 non-commissioned officers and men, of which 58 of the former and 1,296 of the latter are reckoned as combatants and the remainder as non-combatants.¹

The Ersatz battalion in peace time exists only *en cadre*, being 6 Officers and 23 men strong, of whom but two of the former and seven of the latter are combatant.¹ Two Officers, a surgeon, and three clerks are included in this small force as the *personnel* required to carry on the recruitment of the district.

As a general rule, infantry regiments are to be quartered in those districts whence they draw their recruits, and all four battalions should belong to the same infantry division; but exceptions can be made under special circumstances, and individual battalions can be stationed away from their regimental headquarters. If the regiment is ordered away in peace time, one battalion at least must remain with the Ersatz cadre.

The duties allotted to the Ersatz cadre during peace are:—to carry out the yearly recruitment of the district; to keep up the records of those men of the regiment who are not serving under the colours, but who are liable to be called up; and to look after the stores required for a mobilization, as well as the train *matériel* which is attached to the regiment when in the field. In war time the Ersatz battalion is utilized to train recruits, and to send forward reinforcements to supply the place of such who have become *hors de combat*. Ersatz reserve men and men of the year's levy who are not required for military service under the colours, but who are allowed to go upon furlough belong to the Ersatz battalion.

By the Austrian law, men found fit and eligible for military service are divided into three categories, viz.:—The yearly contingent of recruits who are enrolled for active service under the colours, 95,474 men; the Ersatz reserve or a yearly contingent of 9,547 men; and the Landwehr, or the remainder of the year's levy. The first two categories spend the last two years of their military service in the Landwehr, and the force amounts, with the third category, to about 341,000 men. The active army, produced by the first

¹ Table II.

² Table I.

category, is limited by law to 800,000, and the yearly contingent above mentioned is calculated accordingly. The Ersatz reserve also is fixed by law at a tenth of the active army; this force is liable to receive a training of eight weeks per year, but nothing was done to make it available for such home duties as it might be competent to perform. Now, however, the Ersatz troops are to be utilized by employment in the infantry depôts, and thus the men who have been trained to military service are reserved for duty in the field, and thereby the fighting strength of the army will be increased.

The regimental staff expands in war time into 19 Officers (10 combatant), 156 men (8 combatant), and 118 horses (of which 30 are chargers).¹

The company is raised to a total strength of 236 men all told (228 combatant)—4 Officers, 1 cadet, 36 non-commissioned officers, and 195 privates, and 1 charger.²

The regiment for field service reckons therefore in war time 83 Officers (74 combatant), 3,868 non-commissioned officers and men (3,592 combatant) and 134 horses (46 chargers).¹

The Ersatz cadre expands into a battalion of four companies, and into what is termed in the regulation a "staff section." The former consists of 21 Officers (18 combatant), 912 men (878 combatant), and 3 chargers—the Captains of Ersatz companies are not mounted as in the field companies. The latter is composed of 30 men, all of whom are combatant—10 non-commissioned officers and 20 privates.¹ The "staff section" of the various regiments are grouped into "staff companies," four to each company, according to the *ordre de bataille* issued by the War Ministry on mobilization. Three Officers, a sergeant-major, a pay clerk, and a bugler are added to and complete the establishment of the "staff company."

"Staff infantry" in Austria is the term given to such troops as are attached to the headquarters of army units, as orderlies, for the purpose of mounting guard, and in fact to perform all the infantry duties at the headquarters of General Officers in the field. Formerly the different regiments provided troops for this purpose, but by the new regulation the field battalions are to be weakened as little as possible. The same system prevails in the cavalry, since that arm of the Service was reorganized in May 1881; each regiment forming in war time a special troop of "staff cavalry" for orderly, escort duty, &c., without drawing upon the field squadrons for these purposes.

The Austrian system of army organization is essentially one which aims at keeping the combatant units as complete as possible in a campaign. Not only is provision made for a force at the headquarters of General Officers—as has just been said—and for the employment of men in the military police and in the field signalling sections, without trenching upon the normal war establishment of the troops as fixed by regulation, but the *personnel* composing regiments are divided into combatant and non-combatant portions. This latter arrangement is not the result of the new system of infantry reorganization, but was already adopted before, and it will be well to allude to it; for, although we in England make the distinction among Officers, we are not so careful to observe the difference among the men, and our fighting strength is often impaired by the omission. The Austrians classify both their Officers and men. Surgeons, paymasters, quartermasters (*Proviant Offiziere*), and Lieutenants who are charged with recruiting duties are all reckoned as non-combatant. The men are divided into three categories, viz., combatant armed with rifles, combatant without rifles, and non-combatant. In the first are all non-commissioned officers and men in the ranks; in the second, cadets, pioneers, drummers, and buglers; and in the third, clerks, bandsmen, artificers, non-commissioned officers and men belonging to the regimental train, bearers (*Blessirten Träger*), hospital orderlies (*Bandagen Träger*), and all Officers'

¹ Table III.

² Table I.

servants. Exceptions to this rule are rare; two men per company, armed with rifles and belonging to the combatant strength, are told off as shoemakers, and remain with the train as a baggage-guard, and two corporals per battalion (with rifles) are detached from their companies to take charge of the pioneers. As a general rule also the non-combatant portion have no firearms, but an exception is made in favour of the five non-commissioned officers on the regimental staff who have charge of the bearers.

Of the 134 horses belonging to a regiment (excluding the Ersatz battalion), it has already been mentioned that 46 are chargers—30 for the regimental staff and 16 for the Captains of companies; the remaining 88 are draught or spare horses for the regimental train. Every regiment has 34 Government vehicles, viz., 10 baggage, 12 provision wagons, and 4 market carts, each with 2 horses, and 8 ammunition wagons with 4 horses each, together with 4 spare horses, of which 2 only are harnessed. Of these vehicles, 2 baggage, 3 provision, 2 ammunition wagons, and 1 market cart are allotted to every battalion; and when the battalion is detached from the regiment a small addition of horses is made. Besides the above, every battalion has attached to it an impressed country cart for the transport of meat. Drivers for the regimental train are obtained from reserve men in their fourth year who have served in cavalry regiments, and, if possible, they are attached to that infantry regiment to whose recruiting district they belong. Grooms for Field Officers are taken from the establishment of drivers, but there is no provision made for mounted Officers under that rank. The classification of the regimental train remains as it formerly was. The ammunition wagons always follow the troops, and march at the tail of the regiment; the market and meat carts come next, under a sergeant, and are called the “fighting train;” the baggage and provision wagons and cattle, called the “baggage train,” follow after, and may be separated from the troops. The provision wagons, moreover, are employed to transport supplies from the “supply columns” belonging to the infantry divisions, to the regiments. The fighting and baggage trains are technically called the “small train,” and are under the quartermaster (*Proviant Offizier*). The train non-commissioned officer belonging to the Ersatz battalion is usually appointed sergeant-major (*Wagenmeister*) on mobilization, and is the non-commissioned officer in charge of the regimental train. The men carry 70 rounds of ammunition, the ammunition wagons 53 rounds per rifle. The men have, moreover, two days’ rations with them (excluding meat), and a reserve or *iron* ration; by the help of the regimental train there are with the troops four days’ complete rations together with a reserve of sausages and biscuit. If a regiment is employed in operations in a mountainous district, the transport is effected by pack animals, either instead of or in addition to the ordinary carriage. These pack animals and their drivers are obtained from the “mountain train squadrons” belonging to the military train (*Train Truppe*).

There are 61 men allotted to each regiment to tend the wounded in war time. The bearers (*Blessirten Träger*), 12 men per battalion, are under charge of a sergeant-major per regiment and a corporal per battalion; they are provided with stretchers and with a second havresack for lint and bandages. The hospital orderlies (*Bandagen Träger*) are eight in number (two per battalion), and each has a knapsack filled with bandages or a field companion (*Verband-oder Medikamenter Tornister*). Should the force be operating in a mountainous country, the establishment of bearers for the wounded per battalion is doubled.

The pioneers of a regiment are attached for the purpose of making such easy works as may be required on the march, in camp, or during a battle. The non-commissioned officers (two corporals per battalion) are armed with rifles, but the men are equipped with spades, shovels, axes, saws, &c. Although the men belong to the various companies, yet in war time they are united into a “regimental pioneer section,” under the command of a battalion Officer

taken from one of the companies of the regiment. Only half are at the disposal of the commanding Officer of the regiment; the remainder are, according to requirement, concentrated, and at the orders of the General of Brigade or Infantry Division, available to assist in the construction of such larger field works as may be required. These portions of the pioneer sections may be temporarily detached from their own corps.

It should be remembered that in Austria the lowest grand tactical unit is the division, complete in the three arms of the Service, and provided with a train carrying ammunition, supplies, and sanitary establishments; this force is made strong enough to act independently against the enemy, and to sustain by itself a struggle for a certain time. The brigade, on the other hand, is a variable force, and is liable to alteration in accordance with the requirements of the moment. Bearing in mind that the division contains twelve infantry battalions of the line, it now appears that the new regulation has been designed to form that unit of three regiments, just as the army corps is composed of three infantry divisions. Thus, in Austria, instead of having three battalions to the regiment, and the higher units, instead of being constructed upon the twofold system (*i.e.*, two regiments to a battalion, two battalions to a division, and two divisions to an army corps), we have four battalions to the regiment, and the higher units upon the threefold form (*i.e.*, three regiments to the division, with no constant quantity for the two brigades composing it, and three divisions to the army corps); by this means, in a normal formation, the regimental commanders can have a powerful reserve, and each of the Generals commanding divisions and army corps may have a reserve in hand equal to a third of the force they develop in the first line.

The Austrian rifles (*Jäger Truppe*) still consist of the Tyrolese rifle regiment and of several independent field rifle battalions. The former was composed of ten battalions and of ten depôt companies, which on an emergency could form two reserve battalions, and leave behind a small nucleus as a depôt. The latter were formed into forty field battalions and as many depôt companies, which upon pressure might expand into ten reserve battalions.

The Tyrolese rifle regiment now consists of a regimental staff, ten field and two Ersatz battalions (having in peace time a common Ersatz cadre); the field battalions have a battalion staff and four companies each, numbered consecutively from 1 to 40, and each Ersatz battalion five companies. There are only 32 independent field rifle battalions, each composed of a battalion staff and of four field companies, together with an Ersatz company, which in peace time exists *en cadre*.

Thus, where formerly there were 50 service rifle battalions and 50 depôt companies, there are now but 42 field battalions and 42 Ersatz companies. The eight field battalions by which this arm has been reduced have been converted into infantry battalions, and have been incorporated into the new infantry regiments. The Tyrolese rifle regiment, moreover, furnishes in war time two sections of "staff infantry," but this is not done by the independent rifle battalions.

All rifle battalions, whether belonging to the Tyrolese regiment or not, are formed on exactly the same model, and contain the same number of men both in peace and in war time. The rifle company is somewhat stronger than the normal formation of the infantry company, 95 men all told (91 combatants), and has but one establishment in peace time instead of three, *viz.*, 3 Officers, 1 cadet, 16 non-commissioned officers, and 75 privates. On a war footing the field and Ersatz rifle companies are similar in every respect to the corresponding units of an infantry regiment, except that the former have four more corporals each, and have four buglers, instead of two drummers and two buglers.¹

¹ Table I.

The Tyrolese regiment forms a special corps, and the field battalions composing it may be stationed outside their recruiting district; in such cases they are considered for all practical purposes as independent rifle battalions. The Ersatz cadre belonging to the regiment is placed at headquarters at Innsbruck, and may be said to form part of the regimental staff for purposes of recruitment, for keeping up the records of such men as are liable to serve but who are not under the colours, as well as for the supervision of stores and train *matériel* required for mobilizing the field battalions quartered in the Tyrol and Vorarlberg. The regimental staff in peace time consists of 7 Officers (2 combatant), 17 non-commissioned officers and men (non-combatant),—including 5 clerks belonging to the recruiting office,—and 1 charger; the Ersatz cadre of 6 Officers (combatant), and 61 men (50 combatant).¹ In war time the regimental staff remains practically as it was on a peace footing; while the two Ersatz battalions amount each to 22 Officers (all combatant) and 1,145 men (1,115 combatant), and 3 chargers.²

It is intended that all rifle battalions, whether belonging to the Tyrol regiment or not, should be able to act independently in the field, two to each infantry division—the army unit consists of twelve battalions of the line and two rifle or detached line battalions. The battalion staff therefore contains such Officers and men as are required for independent action, and the quartermasters (*Proviant Offiziere*), surgeons, paymasters, artificers, bearers, train, &c., are all attached to it, which is not the case in an infantry regiment, where normally the various battalions composing it operate in the field together. For this purpose, rifle battalions of the Tyrolese regiment keep their own train *matériel* and their stores required for mobilization at the headquarters of the recruiting district in which they are stationed, and those belonging to the independent field rifle battalions are kept with their Ersatz company cadres—that is, in those districts whence they draw their recruits.

The peace strength of all rifle battalions is 17 Officers (14 combatant), 377 non-commissioned officers and men (353 combatant), and 2 chargers. That of the Ersatz company cadre is 1 Officer (combatant), and 2 non-commissioned officers (1 combatant) and 5 men (4 combatant).¹ In war time the battalion amounts to 22 Officers (18 combatant), 975 non-commissioned officers and men (913 combatant), and 37 horses (13 chargers, for the battalion staff and Captains of companies); the Ersatz company to 4 Officers (combatant), and 228 non-commissioned officers and men (223 combatant).²

What has already been said regarding the duties imposed upon the Ersatz troops, the classification of Officers, men, and train, the supply of men for military police and signallers without drawing them from the field units, the bearer detachments, and the arrangements for mountain warfare, applies equally to the rifles; also that relating to the pioneers, except that there is no Officer detached to command them. The train, however, belonging to all rifle battalions is increased by one wagon, and consists of three baggage instead of two, three provision and two ammunition wagons, and one market cart, together with an impressed country cart for the transport of meat.

Comparing the present with the past organization of the infantry, we find, in the first place, that there is no numerical increase whatever in that arm of the Service. The 80 infantry regiments, of five battalions each, amounted to about 398,000 men, all told (about 367,000 combatant); the new 102 regiments, of four battalions, excluding the staff sections, reckon some 403,000 men (377,000 combatant). The rifles formerly were about 50,000 men strong (46,000 combatant), now about 42,000 strong (39,000 combatant). Total infantry of the army of the first line was 448,000 men (413,000 combatant); it is now about the same. Of the dépôt troops, there were formerly 93,000 men (89,000 combatant) belonging to the infantry regiments, and nearly

¹ Table IV.² Table V.

12,000 men (more than 11,000 combatant) of the rifles : total 105,000 men (100,000 combatant). Now there are 95,000 men (91,000 combatant) belonging to the Ersatz infantry regiments, and nearly 10,000 men (more than 9,000 combatant) of the Ersatz rifles. On the other hand, provision has been made for the supply of staff infantry at divisional headquarters and of military police and field signalling sections, without drawing upon the service battalions, and in future the regiments and rifle battalions will not be weakened for this purpose. The employment of Ersatz troops at the depôts also cannot but strengthen the active army, by enabling the infantry to be more easily kept up to the established war strength, notwithstanding the wear and tear of a campaign. With regard to this latter point, it is expressly ordered in the new regulation that when the field units are 10 per cent. below their war establishment, a demand for reinforcements is to be made by telegram direct to the depôt by the Officer commanding either the regiment or the detached battalion.

The actual combatant war strength of the various field companies and battalions does not appear to have been altered by the new system introduced. A slight difference has however been made in the non-combatant portion, due to the reduction of the regimental train, by the withdrawal of two wagons from the regimental headquarters, and one each from the rifle battalions, also by fixing a smaller number of reserve horses for the latter corps.

A great improvement has been effected by introducing uniformity in the regimental organization. The dual system of five battalions to a regiment—divided into a field regiment of three battalions and a reserve regiment of two battalions—was cumbrous and inconvenient, and must have led to difficulties when a sudden mobilization was to be carried out. When regiments were upon different formations there must, moreover, have been complications in the proper supply of the troops during a campaign ; while, from a tactical point of view, the present system is superior to that which has just been abolished, and enables the adoption of a more regular front in the field than could have been the case before the present regulation came into operation.

It appears that one intention of the recent infantry reorganization has been to form 34 infantry divisions for active service. At three regiments per division, there is exactly enough infantry of the line for this purpose ; but the rifles fall short, and could only supply troops for 21 divisions. Formerly the Austrians calculated their complete infantry force, first and second line, at 42 divisions ; 32 divisions ready, one to be formed on mobilization, and nine Landwehr. According to the most recent account, there are 36 infantry divisions, of which four (viz., the 21st, 22nd, 23rd, and 26th) are to be constituted on mobilization ; 15 army corps have, moreover, recently been established ; and, at three divisions each, there ought to be 45 infantry divisions to complete the infantry armed strength of the Empire. Nine infantry divisions are formed out of the Landwehr, two from the Austrian States and seven from the Hungarian Kingdom, which, added to the 34 divisions of the first line, make up 43 divisions. The remaining two might possibly be formed out of the Landwehr of the Austrian States (of which there are as many as 80 battalions) and out of other troops at the disposal of the Government.

In conclusion, it may be said that, while the recent reorganization of the Austrian Infantry has not increased its numerical strength, yet it has brought that force into harmony with the general military policy of the Empire, and has rendered it more easy to keep the troops up to their war establishment when in the field, by the employment of a reserve which up to now has only existed on paper.

TABLE I.—*Peace and War Establishment of a Field Company.*

Infantry Regiments of the Line.				Tyrolese Rifle Regt. and Field Rifle Battns.				
Peace establishment.			War establishment.		Peace estabmt.	War establishment.		
Normal	Increased	Diminished	Field company.	Ersatz company.	Staff section.	Field company.	Ersatz company.	Staff section.
Strength of a Field Company.								
1	1	1	1	1	..	1	1	..
2	2	2	3	3	..	2	3	..
1	1	1	1	..	..	1	..	..
1	1	1	1	4	..	1	1	..
2	3	2	4	4	1	2	4	1
5	8	4	12	12	4	6	16	4
4	9	4	18	18	5	6	18	5
1	1	1	1	1	..	1	1	..
64	100	50	180	180	20	70	180	20
1	1	1	2	2	..	..	..	..
1	1	1	2	2	..	2	4	..
..	..	..	4	4	..	..	4	..
..	..	..	3	3	..	..	..	..
3	3	3	4	4	..	3	4	..
86	131	71	236	228	30	95	240	30
..	..	..	1	..	..	..	1	..
Officers :								
Captains								
Lieutenants								
Cadets								
Sergeant-majors								
Sergeants								
Corporals								
Lance-corporals								
Pay clerks (N. C. officers)								
Privates in the ranks								
Drummers								
Buglers								
Pioneers								
Bearers of the wounded								
Officers' servants								
Total personnel								
Chargers for Captain of company								

TABLE II.—*Normal Peace Establishment of an Infantry Regiment.*

	Regimental Staff.													Companies. ¹		Grand Total.			Combatants.							
	Officers.								Band.		Total.	Chargers.	Officers' servants.	Non-com. officers for train.	Armourers.	Batt. drummers and buglers.	Clerks.	Non-com. officers.	Men.	Officers.	Men.	Horses.	Officers.	Men.		
	Commanding regiment.	Commanding battalions.	Adjutants.	Quartermaster.	Recruiting Officer.	Surgeons.	Paymasters.	Lieutenants.																		
Companies.																										
Regimental Staff and 4 Batts. . . .	16	1	4	5	1	..	4	1	2	11	32	5	1	1	16	5	16	68	5	1,328	64	1,396	58	1,269	Men.	
Ersatz Batt. Cadre	1	..	1	1	1	1	6	1	1	4	..	4	12	..	2	11	6	23	2	7	Officers.
Total.....	16	1	5	5	1	1	5	2	8	11	32	5	2	2	20	5	20	80	5	1,339	70	1,419	60	1,276		

¹ For detail, see Table I.

TABLE III.—*War Establishment of an Infantry Regiment.*

	Regimental Staff.															Companies. ¹				Grand Total.			Combatants.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
	Officers.					Band.		Train.			Horses.			Vehicles.		Total.		Officers.	Men.	Horses.	Officers.	Men.	Horses.	Officers.	Men.	Horses.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
	Commanding regiment.	Commanding battalions.	Adjutants.	Quartermaster.	Recruiting Officer.	Surgeons.	Paymasters.	Clerks.	Non-commissioned officers.	Men.	Battalion drummers and buglers.	Armourers.	Non-commissioned officers.	Drivers.	Butchers.	Purveyors and assistants.	Bearers, non-commissioned officers (armed).										Hospital orderlies.	Officers' servants.	Chargers.	Draught.	Spare.	Baggage and provision.	Ammunition wagons.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				

¹ For detail, see Table I.

TABLE IV.—Peace Establishment of the Tyrolese Rifle Regiment and of an Independent Field Rifle Battalion.

	Staff.													Companies. ¹		Grand Total.		Combatants.	
	Officers.													Officers.	Men.	Officers.	Men.	Officers.	Men.
	Commanding regiment.	Commanding battalions.	Adjutants.	Quartermasters.	Recruiting Officer.	Legal assessor.	Surgeons.	Paymasters.	Clerks.	Battalion buglers.	Armourers.	Non-commissd. officers for train.	Officers' servants.	Chargers.	Officers.	Men.	Horses.	Officers.	Men.
Regimental Staff....	1	1	1	1	1	1	1	2	8	..	1	1	7	1	7	17	1	7	17
10 Battalions.....	..	1	10	10	..	..	10	10	10	10	10	10	50	20	50	90	20	140	3,770
Ersatz Batt. Cadre.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	6	61	..	6	50
Total Tyrolese Regt.	40	1	11	10	1	1	11	12	18	10	11	11	57	21	57	107	21	148	3,848
Battalion Staff.....	..	1	1	1	..	..	1	1	1	1	1	1	5	2	5	9	2	2	9
4 Field Companies..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	12	368	..	12	352
Ersatz Cmpy. Cadre	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	7	..	1	5
Total Field Rifle Battalion.....	4	1	1	1	..	..	1	1	1	1	1	1	5	2	13	384	2	15	358

¹ For detail, see Table I.

TABLE V.—*War Establishment of the Tyrolese Rifle Regiment and of an Independent Field Rifle Battalion.*

	Staff.																	Companies. ¹		Grand Total.			Combatants.												
	Officers.							Train.				Vehicles.						Total.																	
	Lieuts.			Adjutants.	Quartermasters.	Recruiting Officer.	Legal assessor.	Surgeons.	Paymasters.	Clerks.	Battalion buglers.	Armourers.	Non-commissioned officers.	Drivers.	Butchers.	Purveyors and assistants	Bearers, non-com. officers (armed).	Hospital orderlies.	Officers' servants.	Chargers.	Draught.	Spare.	Baggage and provision.	Ammunition wagons.	Officers.	Men.	Horses.	Officers.	Men.	Horses.					
Regimental Staff	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	7	4	60	310	330	160	4	7	18	4	...	...	...	...
10 Battalions	40	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	20	60	90	220	20	70	20	...	...	...	...	...	...	...	...
2 Ersatz Battalions	10	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	4	6	...	...	...	...	...	...	...	...	...	...	...	...	...
2 Staff Sections	10	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	4	10	6	40	6	...	...	...	...	...	...	...	...	...	...
Total Tyrolese Regiment	50	12	13	10	1	1	1	1	1	1	1	1	1	1	1	1	1	71	100	220	20	70	20	71	338	340	200	11,780	40,271	12,118	380	226	11,420		
Battalion Staff	4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	6	9	22	2	7	2	6	31	33	...	...	...	...	...	...
4 Field Companies	4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	16	16	40	4	...	...	...	...	...	...	...	...	...	...	...
Ersatz Company	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Total Field Rifle Battalion	5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	6	9	22	2	7	2	6	31	33	20	1,172	4	26	1,203	37	22	1,136

¹ For detail see Table I.

CONVOYS IN SOUTHERN ALGERIA.

Étude sur l'Organisation et la Conduite des Convois des Colonnes opérant dans le Sud de l'Algérie, par C. Massoutier, Lieutenant au 1^{er} Régiment de Zouaves, Chef du Bureau Arabe de Djelfa. Alger, Jourdan. 1882. Sold by Dulau, Soho Square, London. Pamph., pp. 69. Price 1s. 6d.

THIS pamphlet deals with convoys in a country where the transport is mainly carried on by camels, and the writer has collected the results of the experiences of French Officers on the subject. Major E. Gunter, Garrison Instructor, S.E. District, has kindly analyzed the pamphlet for the Occasional Notes, adding his own remarks on the subject. These remarks are included between brackets, and signed "E. G."—L. A. H.

[Although many of our Officers, who have served in India, and especially those who have taken part in the late campaigns in Afghanistan and beyond our frontier, are well acquainted with most of the points to which the writer draws attention, still some of these are so important that they can scarcely be too often insisted on. The Government of India have now had much experience in the organization of this kind of transport. The reports of the most able and experienced Transport Officers, and of commanding Officers during these campaigns, upon the different systems tried, must by this time have been collected and digested. It would be of advantage if some brief but clear "Instructions" founded on the above experiences were issued officially in handy form (say like the "Instructions for Regimental Transport") for the guidance of Officers in charge of convoys, &c.]

The Sahara in Algeria differs in its northern and southern parts. The former consists of a series of moorlands, with few streams, generally sterile and uninhabited. The southern is made up of great plains and broad basins, whose bottoms are filled with marshy or sandy lakes, sprinkled with numerous oases. It has two distinct populations, the one settled, the other nomadic. The latter pass their lives in the arid plains adapted to rearing flocks and herds. At the beginning of summer, when the wells are getting dry, they travel northwards towards the mountain region, the "Tell," as it is called, their camels laden with dates and woollen stuffs, which they sell there, finding meanwhile grass and water for their animals. The caravan returns in the early autumn to the Sahara.—E. G.]

Lieutenant Massoutier prefaces his account by saying that mule carriage is unsuitable for convoys in Southern Algeria, owing to the difficulty of procuring water and grain *en route*, so, with the exception of a few mules for mountain guns, and for the ammunition and ambulance, camel carriage is employed. He thus enumerates the characteristics of the camel favourable to his utility: he exists a number of days without water, endures excessive heat, and moves with ease along heavy sand, subsists entirely on the desert plants found everywhere, carries a greater load than the mule, and his price is inconsiderable.

[Our experience scarcely bears out the idea that the camel can subsist entirely on desert roots, and certainly he cannot do hard work for long without a supplementary ration of some kind. Indeed the writer himself qualifies his statement by saying afterwards that if badly fed, he languishes and dies.—E. G.]

The camel is, on the other hand, a very delicate animal, suffers much from cold and inclemency of weather, is peculiar in his habits, taking his food only under certain conditions, and if overdriven and badly fed, he languishes and dies.

There is comparatively little difficulty in procuring them in Algeria. The commander of the districts, or of the troops, simply issues a *requisition* for transport camels when a convoy is to be sent off. This requisition indicates :—

- (a.) The number of camels required.
- (b.) The number of bach-hammars or overseers (in Afghanistan *camel sirdars*) for the convoy.
- (c.) The number of sokkhars or camel drivers (in Afghanistan *surwān*).
- (d.) The wages of these men.
- (e.) The hire to be paid for the camels: (1) on the march; (2) when stationary.
- (f.) The date and place of assembly.

This order is delivered to an Arab official, who is charged with its execution. He summons the different tribal chiefs, explains the order to them, and appor- tions the number of camels to be furnished by each tribe.

Ordinarily one driver looks after four or at most five camels.

[In Afghanistan, one driver looked after from four to six camels.—E. G.]

Each driver must carry 30 days' food for himself, water-skins (chaguls) for his own drinking water, and ropes, with hobbles to fasten the camels' legs. Each camel carries a pack-saddle (*kajāwah*) and a pad or numdah with a double sacking (*suleetah*).

Camels in excess of the number actually required are always requisitioned, so as to be able to pick and choose.

The natives do not willingly furnish camels on requisition notwithstanding the advantages offered them. Much inconvenience has often been suffered by the French owing to the tribes suddenly migrating far into the south to avoid the requisition.

Recognizing their unwillingness, the French endeavour to make these requisitions bear as lightly and equably on the different tribes as possible, humouring the headmen, and issuing payments regularly without deductions, and giving liberal compensation in the case of loss of camels. In Algiers, the native prejudices are thus being gradually got over, especially of late years, when they have been very badly off, having suffered much from the great drought.

The camels are regularly "brigaded," as it is called, the animals, *sirdars*, drivers, &c., being regularly mustered, and a driver assigned to every four camels, which he retains charge of during the whole march. If owners, they have charge of their own camels, and, in any case, should always belong to the same *tribes* as the owners of their camels. The camels of one *tribe* are kept together, and always keep the same place in the line of march.

On mustering, a careful inspection takes place of all the animals and their appurtenances. Great care has to be taken to prevent the fraudulent substitution of weakly camels for those animals that have been selected and passed on mustering.

The convoy is then divided into sections of 100 camels, each under a *sirdar*, who has thus charge over 25 drivers. All orders are given through them, and they, with the drivers, are responsible for the loads, of which they keep lists. They must be active, energetic men, who can read and write.

The commander of the convoy keeps a diary, in which he enters daily all changes, accidents, &c. He has generally a soldier clerk to assist him in this.

The natives rarely make their camels carry more than 200 kilos. (about 400 lbs. or 5 maunds) of grain or other substance easily packed.

Their convoys choose the easiest routes, halt at the most convenient times and places to rest their animals, and if the pasturage is insufficient, give them regular rations of grain, &c.

In military convoys these advantages are unattainable. The route must of necessity often cross desert arid regions, and rocky or hilly ground, which is difficult for the camels. Their loads are inconvenient, and hurt them much, and they get no food but what they can graze *en route*. On these grounds loads for camels in military convoys should never exceed 150 to 160 kilos. (about 3 cwt. to 3½ cwt.), and it is better even to keep them down to 120 to 130 kilos. (2½ to 2¾ cwt.). Only two loads should be placed on each camel, and they should always be slung in *suleetahs*. Those used are waterproof.

It is of great importance to balance the loads evenly. Cases and casks are very bad loads for camels, but, up to the present, other forms of packages have not been designed. Wooden casks are used for carrying the water. They contain from forty to fifty litres (about nine gallons) but are not all of the same capacity or shape. They must be soaked in water some time before starting, but even then five or six per cent. of loss has to be reckoned on. They should never be left empty, and, in hot weather, should be wetted outside frequently. Two coopers accompany each convoy for the repair of the casks. Plenty of spare bungs should be carried.¹

Fatigue parties replenish the casks at the different watering places. Only buckets and cooking pots (*sic*) being available for this, the writer thinks it would be of great advantage if small portable pumps were carried for this purpose. On arriving at the wells the surface of the water being always more or less foul should be given only to the animals. After drawing for about an hour the water becomes purer. It is of great advantage to take a few natives who understand the art of drawing water quickly and well (*bheesties*). They are then sent on in front to prepare and clear the wells, &c.

Goat skins and skins of young camels have been tried for water vessels, but without much success.

The advantages of water-skins (*puckals*) generally are obvious. They hurt the animals less and hold more water than the casks. On the other hand they cause as much wastage of water, and deteriorate even more rapidly than casks, as they soon harden, and then split. They are more difficult to procure (!), as expensive, and, on the whole, less enduring. They can be easily pricked, too, by evil-disposed persons without fear of detection. There is no doubt, however, that they are advantageous for long journeys. They should never be placed on the ground where they absorb sand, but on litters or beds of leaves or grass, or, better still, always hung up in the air.

[In India the *bheesties* use a kind of improvised tripod gyn for this.—E. G.]

They can only be managed by the native camel-drivers (!) who understand the difficult art of tying them up, &c.

[Our old soldiers became after a few trials as handy as the most expert of *bheesties*.—E. G.]

These water-skins are tarred *inside* to prevent the decomposition of the water. This gives it a peculiar taste, to which, however, one becomes accustomed (the writer philosophically remarks), and it is very healthy.

When at a distance from the enemy, the convoy marches a certain distance from the protected flank. Spare camels move under charge of a non-commissioned officer with the rear guard, who see that the loads of those camels unable to proceed further are removed to others.

The camels generally move on a front of two sections (that is the leading camels of two sections abreast, with a small lateral space between them), groups of twenty to twenty-five keeping together in a string one behind each

¹ The allowance of water is 5 litres (8 to 9 pints) per man per day, 15 litres (3 to 4 gallons) per horse, &c., per day; one camel carried two 9-gallon casks. 5 per cent. should be allowed for leakage.

other, intervals being left between the groups, which should not be allowed to pass one another.

[There is no doubt that this method of moving two abreast is a great saving of space in column of route. It should be the rule wherever possible. In Afghanistan it was not sufficiently practised.—E. G.]

A certain amount of liberty as regards grazing *en route* is allowed to the camels. No soldiers, &c., of the commissariat or ordnance staff are allowed near the camels for fear they should overdrive them in order to arrive in camp early. No camp followers of any description are ever allowed near the baggage columns.

A special police guard accompanies the convoy. A section (about fifty) of infantry and half a troop of cavalry is considered sufficient for this purpose for a convoy of 1,000 to 1,500 camels.

Striking or ill-treatment of camels or their drivers is strictly forbidden.

Five or six horsemen go in front, a few on the flanks and some in rear to see the camels keep up. The infantry march in the rear, their knapsacks being carried for them.

The usual rate of marching is $2\frac{1}{2}$ miles an hour over good ground. This includes temporary stoppages here and there for browsing, but no halts are allowed.

The camels are never to be allowed to kneel *en route*, unless the convoy is attacked, as this position with their burdens only fatigues and injures them.

From the above it is evident that it is more difficult to keep order and regularity in a convoy of camels than in one of mules. The problem to be solved is how to assure the safety of the convoy, without unduly fatiguing the animals. This demands great activity, vigilance, and experience.

[Our experiences in Afghanistan seem to prove that though sometimes difficult to manage and fractious, mules are on the whole hardier, more plucky, easier fed, and, of course, far more mobile than camels.¹ They certainly require more water. Of this there was generally sufficient in Afghanistan.—E. G.]

The chief losses among camels occur from cold, changes of temperature, overdriving and overloading. Mere bad arrangement of the loads is a frequent cause of bad injuries. A certain percentage of loss must, however, always be expected, and need not be thought too much of.

They will generally go on with their burdens till they drop. The drivers sometimes kill them and flay them for their skins, and, if not looked after, they will sometimes kill them while there is still hope of their living, as the French authorities always give compensation.

The camel will not eat the camel-thorn when saturated with moisture, and it is then injurious to them. They should not, therefore, be sent out to graze while the dew is on the ground.

Camels cannot walk on slippery ground, and suffer much in moving over broken or rocky ground. Undulating ground is unsuitable, as they are from their make and shape obliged to trot when going down hill.

As a general principle camel-drivers should only be armed when of proved fidelity.

On the enemy's approach being signalled, part of the native horsemen (a portion being pushed forward as scouts to the front) surround the camels on all sides to prevent their straggling, and the convoy marches on without hurry or confusion. If an attack takes place, the camels are formed into a compact mass, and then made to kneel, and haltered. The drivers are

¹ Sir F. Roberts' celebrated march from Cabul to Kandahar is a case in point—the bulk of the transport animals being mules and ponies. A few camels were, however, purchased *en route*.—E. G.]

ordered to remain behind them, and forbidden to shout or cry out on pain of death. The infantry are formed in the centre of each of the sides of a sort of square which is formed round the camels, the cavalry towards the flanks.

The police remain behind them near the camels to keep order and prevent plunder.

On arrival in camp, the camels are formed in lines in the centre of the square in which the troops encamp, soft comfortable ground being chosen for them to rest on. They are unladen, the loads being arranged in lines, so as to facilitate reloading, and the camels are then sent out to graze. For this three or four hours are allowed. A camel guard of native horsemen is always sent, even when at a distance from the enemy, to prevent straggling, &c. Camels are easily frightened, and when they are, or when they scent from afar off some more pleasing pasturage, it is astonishing to see the speed with which they "make tracks," and thefts of camels will often take place notwithstanding every precaution. In this case native horsemen are requisite to trace them.

At night the sirdars are held responsible that no fires are allowed, and the police see to this and keep the military away from the camel lines.

[In Afghanistan this was never very strictly enforced. It was found generally that the intercourse between our soldiers and the native camel drivers promoted good feeling.—E. G.]

The camel lives from 16 to 18 years, being used from his third year as a beast of burden. Nearly all are geldings, a few of the finest stallions only being kept for stud purposes in the proportion of 1 to about 50 females. These stallions are for the most part quiet, and can be used for transport, but occasionally, in the rutting season, they become wild and unmanageable, and are then dangerous to men. The period of gestation lasts one year. During this the female is not employed for transport.

As regards the number of camels required for a convoy, that is of course a matter of calculation in each case. A column consisting of 2 battalions infantry, 2 squadrons cavalry, 1 section artillery (3 guns), altogether 40 Officers, 1,000 soldiers of all arms, 200 horses, 100 mules, 200 native horsemen carrying 5 days' water supply, and 30 days' rations carried by the men, is allowed by the regulations, transport in the following proportion, viz. :—

For baggage and material	For staff	6 camels.
for each battalion.....	„ 4 companies at 10 per company, 40	„
	46	„
Ditto for each squadron.....	10	„
For each Officer of superior rank.....	2	„
For the Officers of a company.....	2	„

Notwithstanding every effort the baggage camels suffer the most, as they are invariably overladen and injured by the nature of the packages they are made to carry.

The camp equipage requires 22 camels, hospital establishment 12, besides 12 mules; field battery 10.

In case there are not sufficient mules for the infantry or artillery first reserve ammunition it is carried on camels, which go at the head of the convoy under a special escort.¹

¹ If water has to be carried for five days for the force, it would require, reckoning as above, 63,500 litres (about 13,600 gallons), necessitating for its carriage 756 extra camels.

[This will give some slight idea of the difficulties which had to be encountered by Hicks Pacha on his ill-fated march towards Obeid. An interesting account of the

[In Southern Afghanistan in lieu of the second line of wagons the following was the allotment of camels to the batteries of artillery :—

	9-pr. field battery. Camels.		9-pr. H. A. battery. Camels.	
Cartridges.....	3	.....	3	} Calculated at the rate of 5 maunds or 400 lbs. per camel. Shell in blankets or sacks, 18 in each packet, 36 for a camel. Fuzes, tubes, &c., in boxes.
Shell ammunition	18	.....	18	
Fuzes, tubes, &c.....	1	.....	1	
Blankets and stores....	12	.....	14	
Spare.....	4	.....	4	
	—		—	
	38		40	

The infantry battalion intrenching tools were at first carried on 11 camels, and subsequently 3 mules per company were allotted for this purpose, the tools being carried in iron crates especially constructed for this purpose :—18 shovels, 12 pick-axes, 2 felling axes, 1 crowbar.

2 mules were given to each company for their small-arm ammunition, and one or two for water.

The ammunition mules and intrenching tool mules followed behind the company, and even when marching rapidly easily kept up with the men. Two or three men were told off to look after them.

Each mule carried two ammunition boxes, each containing 600 rounds of Henry-Martini ammunition, and three leathern cartouches.

One camel carried four boxes of small-arm ammunition.

A European regiment 800 strong had 290 camels, 140 mules, 20 horses, 50 bearers for tentage transport, 10 days' provisions, hospital, &c. Some donkeys were also used, and carried about 180 lbs. of grain well. These animals were found of great service for this kind of transport. They were of a cheerful disposition and were well treated.

The *order of march* was generally as follows :—

3 squadrons native cavalry, 2 or 3 miles ahead.

2 companies infantry

1 working company infantry } from leading battalion.

2 guns field artillery.

2 wagons field artillery.

Small-arm ammunition and intrenching tool mules.

Interval, $\frac{1}{2}$ to $\frac{3}{4}$ mile.

5 companies leading battalion with small-arm ammunition and intrenching tools.

4 guns field artillery.

1 wagon field artillery.

1 battalion.

4 guns heavy battery.

6 companies infantry.

2 miles.

$\frac{1}{2}$ troop cavalry at head and on flank.

Train in order of march.

2 companies infantry.

$\frac{1}{2}$ troop cavalry.

The European troops carried one day's cooked rations, and 10 days' provisions were carried in the regimental commissariat train.—E. G.]

The condition of the camel is seen by that of his hump, which in health should be full and firm. He is a delicate feeder, difficult to please. He requires 30 to 40 kilos. of forage a day, and at least three to four

Turkestan Detachment in Skobeleff's campaign against the Tekke Turkomans in 1880 was contributed to this Journal by Lieutenant Leverson, R.E. (vol. xxiv. p. 568).—E. G.]

hours' grazing a day. He can go from four to five days' journey with grazing alone, but it is better then to supplement it by grain, and it is necessary afterwards to give them one or two days' rest in a good pasturage.

[In Afghanistan, when grain was scarce, the ration was eight to ten seers of bhoosa or chaff (a seer being about two pounds), and this was always where possible supplemented by two seers of grain. When no bhoosa could be got, then three or four seers of grain were given.

Some camels which were specially purchased, and were of a particularly fine breed (coming from Zemindawar on the border of the Scistan desert), were given two seers of ata (wheat flour) daily, besides a large ration of bhoosa. These were specially looked after, and were always in good condition, even in long continuous marches, when they carried between five and six hundredweight. A ball of camphor and pepper given weekly or so improved their condition.—E. G.]

The camel endures thirst better than hunger. He can go twenty (! ?) days without water *if not worked*. In the cold weather, when employed in transport service, he can go from nine to ten days without water if they are not exceptionally hot. During the last few days of this abstinence it has been remarked that he scarcely grazed at all.

In summer or hot weather when working he should have water every two or three days, and as a rule he should be watered whenever there is a favourable opportunity, for after long abstinence camels will rush to the water and soon foul it. They seem to prefer clean water, slightly salt. After a long abstinence they should always be watered two days running.

[The writer's remarks on the necessity of more frequently watering camels are well worth attention. Though they can exist a long time without water, there is no doubt that they work better if it be regularly given them.—E. G.]

Lieutenant Massoutier enumerates the diseases of the camel, viz., camel sores, mange, &c., but the most formidable enemy he has in Algeria seems to be the pebab fly, of which the bite is so poisonous as to cause great suffering and frequently death within twenty-four hours.

[Camel sores were treated in Afghanistan with a mixture of kerosine oil and a dash of carbolic acid in a rough and ready way, but it seemed to answer.—E. G.]

The pay of the drivers is issued on every fifth day to the sirdars on a form of pay list showing the name of the sirdar, and the number of drivers, animals, &c., he is responsible for, in separate columns, the rate of hire per day when halted and when marching.

The usual rate is 3 francs a day for sirdars and 1 franc a day for camel drivers, whether halted or moving. The Officer pays the sirdars in presence of two witnesses, and immediately the sirdars distribute it. Each sirdar carries a small book in which every payment made, march done, &c., is entered.

When the drivers have consumed their own rations they are allowed to purchase Government grain, payment for which is made by deductions from their pay.

The usual sum paid for camel hire is a rate of 3 francs per diem when on the march, and 1½ francs per diem when in station.

[As regards the French hiring system, it seems preferable, because the owners always take a certain amount of care that the animals are looked after. Feeding is still a difficulty. Government rations must be given or the camels get out of condition, and the work is not done.

It is impossible, of course, to carry grain enough for all the camels of a force, and it must be supplied by the country through which the march takes place if possible. Where, as in Southern Afghanistan, when Sir Donald Stewart marched up to Ghuzni and Cabul, the country is deserted and the crops all carried away, this is a poor source of supply, and the camels suffer.

In regard to the difficulty of hiring camels, it is seen that even the French have to "*menager*" their people. When, as in Afghanistan, a great part of the population is inveterately hostile, it becomes a matter of great difficulty.

In Southern Afghanistan camels were usually purchased. Price is a matter of supply and demand. The Government price there was 100 rupees. Though it was often difficult to procure *good* animals for this, a fair number could generally be obtained for 120 to 125 rupees.

As regards the general difficulties of procuring hired transport, it does not seem too much to demand from the inhabitants of every country of which we administer the Government, as India, that every owner of carts, horses, ponies, mules, bullocks, camels, should be compelled to *register* annually every conveyance he has and animal for transport in the books of the District Officers (collectors of revenue, &c.), placing his value on each. The Government could then lay their hands, when they found it necessary, prior to organizing an expedition, upon a certain though, perhaps, limited number at a stipulated price.

Since the termination of the Afghan campaign the whole question of transport for Asiatic warfare has been thoroughly gone into in India. The subject has been fully treated in principle and in detail in a series of able essays by experienced Officers in India, the most notable of which are those by Lieutenant C. G. Barrow, D.Q.M.G., and Major King Harman, A.Q.M.G., which have been published with others in No. 46, vol. ix, of the Journal of the United Service Institution of India, which contains much information of value concerning military matters.

Since then the Government of India have set on foot a regular transport scheme as a tentative measure. It provides for half transport for a certain number of regiments on or near the frontiers, and for the creation of transport depôts at the principal strategical points. The basis of the system being that of regimental transport provides for the expansion of the units in time of war. About one driver to every three camels, and about one driver to every two mules, is to be always maintained.

The matter of drivers is certainly of the first importance in the matter of camel transport, so much depending upon the way in which the animals are treated. The necessity of having a large nucleus of *thoroughly trained* drivers in time of peace is all-important.

The question of arming the drivers is still debated.

In Sir Charles Napier's famous camel corps, *one* driver was appointed to each camel, and armed, drilled, and taught to fight.

These were divided into divisions of 600 each. The system answered well, no grazing guards, escorts, fatigue parties, &c., being required.

On the other hand, the Bombay bullock cart drivers employed in the Bolan Pass were armed, and once or twice the Murrees came down to cut their throats with their own swords that they did not know how to wield.

There is no doubt that the drivers should be well organized and under strict discipline. This is quite compatible with treating them well and liberally.—E. G.]

REVIEWS.

Die Anlage, Leitung, und Durchführung von Feldmanövern. Von A. v. Boguslawski, Oberstlieutenant. Mit 15 Skizzen und 1 Figurentafel.

The Arrangement, Direction, and Execution of Field Manœuvres. By Lieutenant-Colonel A. v. Boguslawski. With 15 sketches and 1 plan. Berlin (Ernst Siegfried Mittler und Sohn), 1883. Size 8 $\frac{3}{4}$ " x 6". Weight 9 $\frac{1}{2}$ ozs. Price 5s. 6d.

Lieutenant-Colonel von Boguslawski has been so long known, both in his own country and in the rest of Europe, as a profound thinker, and as an able writer upon military subjects, and more especially upon tactics, that whenever any work of his is announced as forthcoming, its publication is looked forward to with eagerness by the little world of military students in all countries.

The present work, though from its nature of less engrossing interest than many by the same author which preceded it, is nevertheless of considerable value, both on account of the information contained in it, and also because of the many useful suggestions made by the writer for the improvement of "field manœuvres," a branch of military training now recognized in most European countries as essential for the purpose of completing, as far as this process can be carried out in peace, the professional education of the soldier, and of the Officer.

We purpose giving a brief analysis of the work before us, with special notice of whatever appears applicable to our own army.

The author states at the commencement of his preface, that numerous as are the works on every branch of drill and tactics, no really comprehensive treatise has hitherto been published on the combined exercises of all arms, known in Germany by the name of "manœuvres." The absence of such a work in that country may, he thinks, be accounted for by the existence of the excellent official "Regulations for the Training of Troops in Field Duties, and for Exercises of the more advanced Description," which regulations, however, were issued just before the war of 1870-71, and came into force without any modification immediately after the war, before its lessons were sufficiently understood, since which time, moreover, many important alterations have taken place everywhere in tactics and in armament. The writer thinks, therefore, that it is high time to review the effect of these regulations upon professional opinion, and the manner in which they have been carried out in practice, also to discuss the experience gained in Germany and elsewhere since their issue. He proceeds to describe the plan of his work, which commences with an historical sketch of the development of war training, especially in the shape of field manœuvres as practised in Germany, a branch of training which he considers and aims at proving to have exercised a very great influence upon the result of more than one campaign, from which he deduces the necessity of keeping in advance of other nations in this respect, a position, as he says, "undoubtedly held by the German Army up to the last decade." "The field manœuvres of the present day should include every feature, tactical or strategical, which can be embodied in peace practice; they should serve both to train the men and to instruct Officers in the art of leading them in battle. So various are the aspects of the subject, that it must be treated in a very comprehensive manner, and if it be allowed that the *field manœuvre* should be as near an approach to actual warfare as possible, we should seek to make it a true picture thereof, and not a caricature." After the historical sketch comes the main body of the work, consisting of three parts entitled—1. The Arrangement; 2. The Direction; 3. The Execution. Each of these parts contains several chapters in which the author gives his general views, and also discusses at considerable length the construction and manipulation of the various parts of the

machinery which places the manœuvring troops in the field, and keeps them in action. Thus we see by the table of contents that the following matters are dealt with:—Preparatory arrangements—The plan of the manœuvres prepared—Subsistence—Formation of detachments—How military considerations affect the plan of operations—The employment of troops kept in hand at the disposal of the Director of the manœuvre (*Verfügungstruppen*)—How peace conditions affect the plan of operations—Examination of the directions given by the leaders of the two parties—The situation judged—Possible alterations—Personal demeanour of the Director during the manœuvre towards leaders, troops, and any higher authorities who may chance to be present—Commencement of the manœuvre—Collision—The Director intervenes by the use of supposititious troops; of assumptions; of a marked enemy; of troops held in reserve; by his final decision.

Umpires and their Action.—Crisis of the manœuvre—The situation judged—General decision of the Director—His conduct when one party retreats, and when the manœuvre is brought to a close—Interference in case of action inconsistent with the conditions of warfare—The necessity of pushing an attack home—Considerations affecting the welfare of the men—The critique—The situation determined—Communication of orders—Receipt of the general idea—Issue of orders—Recommencement and termination of a manœuvre—Throwing out a chain of outposts—The presence of umpires necessary whilst this is being done—Communication of orders before the manœuvre—Directions and communication of orders during the manœuvre—Personal demeanour of the leaders—Assembly of the troops—How they are screened from the observation of the enemy—The attack in its various forms—The defence—An example of unusual conduct—A feigned retreat—An ambush—Use of the different arms—cavalry, artillery, infantry—Close of the manœuvre—Examination of a position—Positions on which to rally—The signal “Halt”—Course pursued when the command is handed over to another Officer—Reports.

This completes the “main body” of the work, the concluding part containing some of the author’s suggestions for the amendment of the system of field manœuvres as now carried out in Germany, other suggestions of the same nature being scattered throughout the book. What is a “field manœuvre” properly so called? Not a mere repetition on ground more or less varied of drill movements already practised in the barrack square; what we call a field day—not the same, with the addition of an enemy indicated by flags or by skeleton battalions of men—not a “sham fight,” when there is indeed both an attacking and a defending party, but when the whole course of the action is arranged beforehand, when it is well known which side is to be victorious, and when every probability must be sacrificed to the supposed necessity of a general march past at the end of the day’s proceedings. These forms of field exercise are all useful in their way (except perhaps the last) as preparatory to the “field manœuvre” proper, which, to use the author’s words, is the “representation of an act of war in which the leaders of the two parties opposed to one another, as well as their followers, enjoy perfect freedom of action, each being expected to perform in the manner which seems to him best the task assigned to him on the ground of certain definite assumptions. We may be quite sure that neither party will do perfectly right, and, moreover, that there will generally be a great difference of opinion at the time as to what course is perfectly right; but we may also rest assured that as the field manœuvre proceeds the propriety of one course of action and the impropriety of the other in any given case will become evident enough if the manœuvre is properly directed.”

From the earliest times, and in every country where bodies of armed men have acted together, it has been necessary for them to undergo some system of drill and training, but it was only at the end of the 17th century that the first symptoms of the field manœuvre are recorded. This took place in France, where during the intervals of peace Louis XIV’s troops formed occasionally camps which became places of fashionable resort, and where amidst all the splendour and dissipation of the Court “sham fights” took place representing the attack and defence of entrenchments and such like. The same fashion was soon after imported into Germany, but no progress was made until after the Great Frederick’s first Silesian war, when these exercises called “war evolutions” became much more practical.

Still they were merely large field days, the enemy not being even *marked* till after 1750, and although they were very useful in training the troops to the extreme precision of movement which was considered of paramount importance in those days, and which enabled Frederick to perform some of the wonderful tactical feats for which he is celebrated, they never deserved the name of field manœuvres. Towards the end of the great king's life, the "war evolutions" lost somewhat of their martial character, and after his death degenerated into mere routine—the spirit had departed, the letter alone remained. Meanwhile other nations had been progressing on the same path; in Russia, Austria, and France, camps of exercise became habitual; and we find it recorded in "Dumouriez's Memoirs" that in the last-named country, during the latter half of the 18th century, manœuvres took place with one corps operating against another, apparently the first of this description.

During the time of the French Republic and Empire there was but little opportunity in any country for *peace* manœuvres, but the Prussians were most assiduous in drill and in the performance of the minor tactical exercises from the time of their great disaster up to that of the war of liberation, the effects of the careful training being made manifest by their superiority in manœuvring power. In the meantime the true principles of the higher military training were making their way in the army, the consequence of which was the issue of the order of May 12, 1822, for regulating the great autumn manœuvres, which were divided into the field exercises of large bodies and manœuvres in two bodies, to which latter part seven days were allotted.

Thus the system of *field manœuvres* as now carried out in Germany really originated in 1822. Nearly half a century was fated to elapse before the armies of Prussia were again to take the field in actual warfare. It was no doubt in no small measure owing to the regular practice of *field manœuvres* that when the time came both Officers and soldiers of that nation showed an efficiency totally unexpected by foreign critics. But this system did not at once come to maturity. Its excellence was of slow growth. In the early years financial considerations much interfered with its development, and in 1828 the time allowed for manœuvring was much shortened; and for some time after the influence of a long peace betrayed itself by excessive attention to detail and by the sacrifice of practical considerations to those of mere display. In fact, the Army of Prussia was in danger of becoming, what those of other countries did more or less become with less excuse during the same period, a superior kind of showy police; but it was saved from this risk by the orders of July, 1840, which gave a fresh impetus to the higher military training, and made the *field manœuvre* a greater reality than it ever had been. From that time forward it has been a permanent and honoured institution in the Prussian Army, and continues to be so in that of Germany. For another generation, however, Prussian soldiers continued to be spectators whilst their neighbours now and again waged war. The orders for field exercise issued in 1861 showed that they were not idle spectators, but that they were profiting by watching the doings of others. There came at last the time for them to apply the lessons learnt in peace to the realities of war. The first application on a large scale was wonderfully successful. Still thoughtful men detected many tactical defects, and great changes were determined upon, which were introduced into the Service by the orders prepared, as we have noticed, before the war of 1870–71, issued immediately afterwards, and substantially in force at the present moment, though in Colonel von Boguslawski's opinion requiring revision.

Whilst Prussia had thus, with little interruption, been making constant progress for nearly half a century, the other European Powers had not been altogether idle, though until the war of 1870 their system of training was far behind that of the nation, which they all more or less endeavoured to imitate after that war. The great defect everywhere was, that the field exercises, on however large a scale, did not rise above the level of "field days" and "sham fights." The great principle of leaving the issue of the contest between the two manœuvring forces to be determined, as far as it can be in peace, by the ability of the Commanders and by the manœuvring power of the troops—the principle, in short, which is the distinguishing feature of the true field manœuvre—was everywhere absent, and in consequence there was a want of reality in the whole performance which was very

damaging to professional instruction. After 1871 all nations recast their systems of training more or less according to the German type.

The French introduced the system thoroughly, as far as regulations go, and in some respects, indeed, outdid their neighbours; for instance, as to the number of corps operating, and as to the proportion of reserve men called out; but it seems that as yet the great principle above referred to has not been completely accepted and that the unwonted liberty of action when granted to Officers, as it is sometimes is somewhat unpopular with them, because they are at a loss how to make use of it. The case is doubtless the same everywhere under similar circumstances; but you must do away with the leading-strings in peace-time, in tactical as well as in other matters, if you want leaders who can judge and act for themselves in war. The French Army is now guided by the "Instructions for regulating Autumn Manœuvres," issued in 1879, and going very much, perhaps too much, into detail. In Russia, in Austria, and in Italy progress has latterly been made, though much still remains to be done. In all these countries the great principle which regulates the true field manœuvre is accepted as correct, but in none of them is it acted upon so thoroughly as in Germany, and until this is the case the armies of all those nations must remain inferior to that of Germany as far as regards the training of Officers, and especially of those in the higher grades.

Colonel v. Boguslawski has very little to say about England; and indeed, in the matter of field manœuvres, as the Colonel understands them, there is but little to be said about this country, where that branch of military training is still in its infancy, either because not appreciated as it should be, or because, like Prussia for some time after the war of liberation, Great Britain is too poor to spend sufficient money upon such matters. In the poorest country, however, if it is thought necessary to maintain a standing army at all, those in supreme authority would do well to ponder over the deductions drawn by the writer of the work before us from the history of the progress of warlike exercises, that the "same may either contribute largely towards victory or may prove merely a costly farce, according to the mode in which they are conducted, namely, whether they are in harmony with or in opposition to the realities of war."¹

The space at our disposal will only allow of a very brief notice of the many important points touched upon by the author. In pages 33-36 will be found a good description of a district suitable for field manœuvres, which is the first thing requisite for carrying them on, and which is by no means easy to find in some highly-cultivated and thickly-populated countries. There is, however, a sufficient abundance of such districts in Great Britain and Ireland. The German military authorities disapprove of encamping troops when engaged in field manœuvres, principally on account of the unreality of the proceedings; consequently troops are placed either in bivouacs or in cantonments. As it was found that frequent misunderstandings arose between the civil and military authorities with reference to the quartering of troops upon the inhabitants, mixed commissions were appointed in 1880 to regulate such matters. Details are given in pp. 36-38.

It is the custom in Germany to form dépôts of provisions in the district selected for a field manœuvre, and to obtain supplies by contract, hired transport being employed to convey the provisions from the dépôts to the troops. This is all very well when there is only an imaginary or marked enemy, in which case the night-quarters of the different corps are assigned beforehand, but in the case of a real "field manœuvre," the result of which is doubtful, delay is likely to arise in bringing up the rations in the evening, and although such accidents will frequently occur on actual service, and must then be borne cheerfully, the utmost care should be taken to prevent this occurrence at peace manœuvres. This can only be done by attaching well-horsed provision wagons, containing two or three days' supplies, to

¹ Whilst writing thus of England we do not forget the practice of "minor tactics" by small forces of all arms introduced amongst us some years ago, and still regularly carried on. The "minor tactical" field day is really an infant "field manœuvre," and may be made most useful in teaching Field Officers to handle mixed bodies of all arms.

the manœuvring troops. These should be supplied by the military train, and the regimental transport should also take part in the manœuvres, a practice not at present followed in Germany, though habitual in France. (See pp. 39-40 and 200-202.)

The plan of the manœuvre must be greatly influenced by the time allowed for it and by the number of troops engaged. Our author thinks that a greater expenditure of time and a larger concentration of troops is advisable than is the case in Germany. At present strategical combinations in which the employment of independent cavalry divisions would be most instructive must of necessity be almost excluded from the plan of operations; and the director of the manœuvres (umpire-in-chief) is so pressed for time that he is bound to do his utmost to ensure an early collision between the contending parties. It is desirable, too, that the strength of tactical units should be brought more nearly to the war establishment than is done in Germany. In this respect the French set a better example (see pp. 43, 44, and 194-197). Casual encounters (*Begegnungsgefechte*) (see p. 50) are too often produced at peace manœuvres, and very unnatural situations are the result thereof. In actual warfare they are quite exceptional (Solferino for instance). A very early hour should occasionally be chosen for commencing the day's work: night marches should be practised and attacks by surprise at early dawn. "Night attacks also on a large and small scale should be executed. It seems indeed desirable to establish as far as possible by actual experiment at our manœuvres, on some early occasion, how far the opinion which some hold is justified, that great results are to be expected in future from such attacks. In the war history of Prussia we find records of night attacks on a large scale, one of which (Hochkirch) was a success for our enemy, whilst the other two (Laon, 1814, and Le Mans, 1871) were victories for our own troops. All three show, therefore, that attempts of this kind may succeed under peculiar circumstances. In the first case success was due to Frederick's carelessness, in the two latter cases to bad discipline and want of watchfulness on the part of the French troops. We do not expect much from the night attack as a regular mode of warfare. It may, however, render good service as a last resource and under exceptional circumstances. . . . It is therefore surprising that we should continue to promote indolence and want of mobility by banishing night attempts from the field of manœuvre" (see p. 203). We have quoted this passage somewhat at length on account of its peculiar interest at the present time.

Officers and men should be trained to secrecy as to orders received and movements intended. Such secrecy is necessary in war, and the habit thereof should be acquired in peace (p. 58). The corps opposed to one another should be of unequal strength from the first, or this inequality should be produced in the course of the operations by the employment of troops placed at the disposal of the director of the manœuvre (*Verfügungstruppen*) (p. 59).

The director of the manœuvre must fix the moment for commencing operations, and should a surprise be planned by either party, it should not be attempted without informing the director, who should have the opportunity of being present throughout the operations (p. 78). He should endeavour to see as much as possible himself, but, as he cannot be everywhere, his staff and the umpires should keep him informed of what happens beyond the range of his vision. He should be calm and impartial, careful and moderate in his language and in the expression of his opinions. He should not attempt to give advice or instruction during the manœuvre or to correct mistakes, though he should take careful note of everything for subsequent remark. In order to do his duty efficiently, he should be hardy, vigorous, a good horseman, and well mounted. He should at critical moments manage to be near one of the commanders of the contending armies, so as to observe his demeanour and his actions; in case of any change of disposition he should question the commander as to his reasons for the same, but he should guard himself against embarrassing him. All this requires tact, judgment, and experience. The director of a manœuvre "should during the course thereof rather observe than criticize, rather question than answer, and in general rather hold his tongue than talk" (pp. 78-83).

The director may, however, alter the character of a manœuvre by producing a change in the situation through the introduction of actual reinforcements to one or other party (as before noticed), or of *marked* troops or of supposititious troops.

Should he have resort to these means, the change of situation should be produced in a natural and service-like manner. Finally he may find it necessary to put a stop to a manœuvre by his interference and decision, should neither of the two parties consider itself compelled to give way after coming into close contact (pp. 83-88).

What has been said as to the qualities required of the director and of his demeanour applies also in a minor degree to the umpires. They must, above all things, understand the part which they have to play, and that is "*to decide upon the tactical situation when two bodies of troops come into collision, and nothing more.*"

It doing this the umpire must beware of being influenced by personal feeling or by prejudice in favour of any particular corps or arm, or of any particular form of tactics. He must calmly weigh the pros and cons simply from a tactical point of view, and give his decision as quickly as possible. Except when giving his decision, he must refrain from any expression of opinion.

The considerations which should guide him in coming to a decision are—1, the relative strength of the contending bodies; 2, the moral effect which a similar situation might be assumed to exercise upon the combatants in actual warfare (plenty of room here for difference of opinion); 3, the formation of troops on each side; 4, the probable effect of fire on either side; 5, the advantages and disadvantages of the ground to either party. Many umpires only take the first point into consideration, which doubtless simplifies the way to a decision, but is a poor mode of solving the question, as numberless instances of success in action on the part of the numerically weaker body suffice to show.

The umpire should never forget that he is on horseback, and that things may look very different to one in his exalted position from what they do to the actual combatants, and this difference of position must especially be borne in mind in estimating the effect of fire. Colonel v. Boguslawski criticizes a proceeding on the part of umpires which he says is habitual. An attack upon an enemy in position has been pronounced to have failed, but it is decided at the same time that if repeated the attack will succeed. "Upon this the assailant retires, halts and fronts, advances a second time, and carries the position. The decision of the umpire should be just the reverse. If an assailant is forced to retire under the enemy's fire after an unsuccessful attack, he should be considered unable to take the offensive for a long time afterwards. A retrograde movement under the fire of breech-loaders means death." This criticism seems just, always supposing that the assailant receives no considerable reinforcement after the failure of the first attempt, as the critic indeed notices further on. Again, the author finds fault with the habitual action of umpires in the case of a cavalry combat, in that they do not in general act up to the regulations on the subject, regulations which, like most of those emanating from the German War Office, are calculated to give the utmost possible reality to the representation of war (pp. 94-98). When a body of troops is pronounced by an umpire to be *hors de combat* it is, according to the German regulations, ordered to join the reserve of the force to which it belongs. The author does not approve of this course, and prefers their being completely ignored as combatants for as long a period as the umpire may decide (which is, we believe, the custom in our Service). However, do what you will it will be found difficult, if not impossible, to preserve even an approximation to reality in dealing with cases of this sort.

Both the director and umpires must insist on the observance of the regulations made to prevent accident and ill-feeling; at the same time they must take care not to enforce these regulations to the prejudice of warlike reality. This is not sufficiently attended to. For instance, when an attack has been successful you generally hear it said, "Don't press upon the retreating enemy. Give him time to withdraw." This is a mistake. All that the umpires have to do is to insist upon the minimum interval allowed between contending forces being maintained, which is arrived at by obliging the retiring force to continue its retreat without unduly checking the advance of the pursuers.

But the variety of the situations which may arise when two bodies of troops composed of all arms contend together in mimic warfare is very great, and when large masses are operating it must be difficult for even the most highly-trained body of Officers to furnish a sufficiency of really efficient umpires, men whose decisions will be accepted as law by all those competent to judge. The eleventh chapter of

the book before us is one of the most important, and most worthy of study. We have, however meagre may be our notice, devoted to it as much space as we can afford, and must now pass on.

Chapter 12 deals with the "crisis of the manœuvre" and with the director's verdict. The latter will be more or less difficult to arrive at according to the nature of the country, whether open and comparatively level, or enclosed, wooded, and much broken. But even in the former and most favourable case, the observer at peace manœuvres will be under a disadvantage when compared to the looker-on in actual warfare, in that many symptoms of defeat or of victory which are plainly evident to the latter are wanting to the former. Consequently mistaken verdicts are not uncommon, particularly if the director is the sort of man who makes up his mind as to how the affair ought to end, and is incapable of altering his views, or if he be badly served by his staff. In war most fights end by one or the other party evacuating the field of battle. So must it be, as a general rule, at peace manœuvres; but it sometimes happens that neither army gains any decided advantage, and that the two forces continue to hold their original positions at the close of the day. This sort of situation must also be represented in mimic warfare. It will then be for the director to decide whether he will introduce into the plan of campaign a supposition of such a nature as to force one or other party to retire, so as to allow a sufficient interval for regular chains of outposts, or whether he will let the opponents bide where they be, in close proximity to one another and under arms, as they would be in a similar case on actual service, a case too of not infrequent occurrence, and which should therefore be practised, though rarely, for manifest reasons (pp. 107, 108). It seems to be too much the custom in Germany, as it is elsewhere, not to allow an attack to be carried out to the bitter end, but for the director to order the "Halt" to be sounded just as the actual assault is beginning. This is a mistake, for, to use our author's words, "the consequences of defeat should be made manifest—completely and sensibly so to those engaged. . . . It is just the retreat and its accompaniment by the fire of the assailant which first proves that the attack has been well conducted and that the assailant has been judiciously led. The work lacks completeness if not brought to the final test. Troops must be accustomed to push the attack home, bayonet to bayonet. It is only when they stand upon the conquered ground, pouring their fire into the retreating foe, when the cavalry, wheeling round the flanks of the infantry or passing through its intervals, falls upon the fugitives, when the artillery, galloping up into position, unlimbers, then only can the soldier realize the losses which are the consequence of retreat in war, and understand with what stubbornness he must defend himself, with what vigour he must attack his enemy" (p. 111).

Now we will suppose the battle over. The signal "Halt" has been sounded, followed by the "Assembly" and the "Officers' call." The troops repose and refresh themselves. Mounted Officers hasten to the umpire-in-chief, who chooses as commanding a spot as possible. Before judgment is given, the two commanders repeat the special ideas upon which they have been acting, also any instructions received at first or subsequently. All this in a clear and loud voice, so that every one may hear. The director, who has previously received reports from the whole of his staff, and who has also probably taken notes of all that occurred under his personal observation, now, if necessary, asks the commanders to explain some points which may appear to him doubtful, after which he proceeds to give his decision, which should above all be thoroughly impartial and strictly confined to the case in question. He should commence with a short but clear sketch of the operations and of the manner in which they have been carried out, taking care not to enter too much into detail. Whilst doing this, he will mention any cases which have come to his notice personally or by report in which he considers the troops or their leaders to have deserved praise or blame, and will point out the results arising from the acts referred to. Thus carrying on his narrative and critique *pari passu*, he will come to his verdict upon the day's operations. He will do well, after giving it, to ask his hearers whether any one of them disagrees with him as to his statement of any *fact*, and if so to give his own version of it. Should any statement be made in response, the director should duly weigh it and determine what effect, if any, it may have on his decision, which should then be final and without appeal. After giving it, the

director will proceed to determine the military situation resulting from the decision given. This will influence the positions taken up for the night by the contending parties.

It is a common custom in Germany to change the commanders of the contending forces daily, so as to give as many Officers as possible the opportunity of command. The most convenient time for making the change is immediately after the critique, at which time also the general idea for the next day's operations is given out, being either devised there and then in accordance with the situation or prepared beforehand. The former plan seems preferable, as the latter is likely to lead to undue interference with the liberty of action of the commanders.

It is well if possible to quarter the troops at night as they would be under similar circumstances in war. This cannot, however, always be done, owing to the nature of the country and to other considerations, but on no account should the troops of the two armies be intermixed, and the outposts at least should be posted as on service. Next morning the operations recommence on the director's signal.

Colonel v. Boguslawski's remarks upon the manner in which outpost duty is usually performed, especially by the cavalry at field manœuvres, and how it should be performed, are particularly valuable, and we should like to give them *in extenso*, but must deny ourselves that pleasure. The reader will find them in pages 126-131, and will observe that even in Germany the mode of performing this important part of field duty at peace manœuvres leaves much to be desired. Chapter 17 contains much interesting matter, being devoted to the general tactics of offence and defence. The subject is treated in a masterly manner, as was to be expected of the author of the "Development of Tactics from 1793 to the present Time." The remarks upon the use and abuse of flank attacks and turning movements, and those upon practice in constructing, attacking, and defending entrenched positions, are especially worthy of notice (pp. 153-157, 158, 159). Chapter 18 treats of the tactics of the different arms, and points out many absurdities and improbabilities arising from the manner in which troops are handled at peace manœuvres, and which may be remarked more or less in all countries. The author does not appear to agree with the many able Officers of his nation, who expect great results from the action of cavalry in large masses upon the battle-field, which, as is well known, has been much practised of late years in Germany; on the other hand, he thinks that sudden attacks by comparatively small bodies will often be of great value, and that fighting on foot should be paid much more attention to at field manœuvres than is now the case. The Russians may give us all a lesson in this respect some day. In discussing the co-operation of artillery with infantry in attack the author prefers that the former should support the latter by firing from a well-chosen position over the heads of the assailants rather than by accompanying them to close quarters, a course recommended by some tacticians, and which has doubtless been occasionally pursued with effect though with heavy loss to the batteries engaged, even since the introduction of breech-loaders. The author's opinions upon infantry tactics seem to have undergone but little change since he wrote "Tactical Deductions." Many have been the theories started, and many the experiments made, in the intervening period. The most remarkable of these are noticed in Chapter 18 (pp. 179 and 183). The author is convinced of their fallacy, and still advocates the same general principles which are too well known to require further mention. They will be found concisely given at page 182.

But we must now bring to a close our imperfect notice of this valuable little book, which will, we hope, become widely known amongst us, and we will conclude by quoting some of the last sentences in the work, sentences thoroughly applicable to all armies.

"Our field manœuvres may be good, but they are capable of improvement. In order to be a real school of war they should be further developed. To train the leader and test his capacity, to develop the powers of the men, thus steeling the heart and strengthening the character of army and nation—these are the ends which they are intended to fulfil.

"The best test of soundness in an army is the mode in which its field manœuvres are directed and executed."—L. G.

Stratégie. A Study by Colonel Blume, 36th Magdeburg Fusiliers. Berlin, 1882. Mittler and Son. Pp. 261. Size $9'' \times 6'' \times \frac{2}{3}''$. Weight under 14 oz. Price 5s.

Military literature of late years has found an abundant harvest in works on tactics, but a treatise on strategy is of comparatively rare occurrence. The present volume, although somewhat too philosophical for the English taste, is worthy of study; not only on account of the high military repute of its author, but because the method of treating the subject is probably unique. In style, Colonel Blume's diction approaches more to that of Clausewitz than to any other writer we can call to mind.

"Strategy," says Colonel Blume, "is an art and not a science. The masterhand shows itself rather in comprehensive view, penetrative judgment, versatile genius, and, particularly, in force of character. Any attempt to reduce strategy to a definite scientific system would be in contradiction to its nature. Theoretical studies can only aim at training the mind to grasp strategical situations, and to employ aright strategical combinations, and at inculcating general principles."

For the end he has in view, Colonel Blume leaves the beaten track of the majority of his predecessors, who, taking military history as their starting point, endeavour to trace through it the relation between cause and effect. He commences with a study of the forces working in war, and of the sphere of their action. On this, as a basis, and using as guides the experiences and teachings of military history, he draws his deductions.

A great part of the conditions, upon which depends the success in battle of the opposed forces, must be derived from a study of the nature of those forces. Hence, as a first step, Colonel Blume enters into the organization of the forces, the attributes of the different arms, the conditions of their existence, the rôle they respectively play in the different circumstances of war. He then proceeds to consider the strategical employment of the forces for overcoming those of the adversary.—F. C. H. C.

Les Télégraphes et les Postes pendant la Guerre de 1870-1. Fragments de Mémoires Historiques. Charpentier. Paris, 1883. Pp. 620. Size $7\frac{1}{2}'' \times 4\frac{1}{2}'' \times 1\frac{1}{2}''$. Weight 1 lb. 2 oz. Price 3 fr. 50 c.

M. Steenackers was, on the arrival of M. Gambetta at Tours from Paris, invested with the supreme and combined direction of the Telegraph and Post Services in the Provinces. The book, like so many French works, contains for general readers far too much of "No. 1," and the differences of opinion between "No. 1" and the rest of the world, but, nevertheless, it is full of interest. In it we have a most readable account of the means resorted to open and maintain communication between a beleaguered city and the provinces, and of those adopted to disturb the telegraphic communications among the invaders.—L. A. H.

The Elements of Military Administration and Military Law. By Lieutenant-Colonel John Boughiey. 8th edition. Webb, York Town, Surrey, 1883. Pp. 221. Size $8\frac{1}{2}'' \times 5\frac{3}{4}'' \times \frac{3}{4}''$. Weight under 14 oz. Price 5s.

This book, which is used as a text-book at the Royal Military College, was originally compiled from the printed notes which were issued to the students there during the course of lectures on administration and law. It pretends, therefore, to be nothing more still than a note-book giving a general outline of the subjects with which it deals, and is intended to assist Officers in passing for promotion and in the garrison courses, as well as for the use of the gentlemen cadets.

The First Part relates to recruiting, showing the relative advantages and disadvantages of the long and short service, voluntary and compulsory enlistment, &c.; enlistment, describing its condition, the localization and mobilization schemes, and the peace and war organization of the Army; reserves, giving the liabilities and terms of service of Army and Militia Reserves and the auxiliary forces; pay and

allowances, dealing with regimental pay, good conduct pay, and deferred pay; accounts, with examples of ledger, savings' bank ledger, and balance and cash account sheet; rewards for long service, &c., defining the nature of annuities and pensions; supply and transport, at home and abroad, in peace and in war, chiefly as far as the regiment only is concerned. It will be seen from this abstract of its contents that the first part of the book touches upon these questions, which form, or should form, the essential elementary knowledge of a regimental officer; and it is put together in such a manner as to avoid the continual reference to the authorized official books, which would otherwise be necessary.

The Second Part, devoted to military law, is also divided into chapters in the following order: First, introductory; giving the upgrowth of the military code, the difference between military and martial law, and the duties of provost-marshal. Second, on courts-martial; describing the Army Act, and the nature, powers, and jurisdiction of the various courts. Third, on the proceedings before trial; from the commission of the offence to its examination by the commanding Officer (whose powers are given), and the framing of the charge on which the offender may be tried. Chapter four deals with the proceedings of the court itself, and gives the duties and regulations with regard to the different members of the court and the procedure during and after the trial. Chapters five and six touch briefly on the laws of evidence and the composition of Courts of Inquiry and Boards.

Some useful appendices, giving a synopsis of the sections of the Army Act, an example of the form of proceedings of a regimental court-martial, &c., are valuable for reference, and a careful index, absolutely essential where such a mass of facts have to be referred to, renders the subject-matter of the book easily accessible. —C. K.

Die Kriegsschiffbauten, 1881-2. Zusammengestellt von J. F. von Kronenfels K.K. Hauptmann D. R., mit 82 in den Text gedruckten Illustrationen. Das schwimmende Flottenmaterial der Seemächte. Erster Ergänzungsband. Hartlebon. Vienna, 1883. Pp. 275. Size $9\frac{1}{2}'' \times 6\frac{1}{4}'' \times \frac{3}{4}''$. Weight under 1 lb. $5\frac{1}{4}$ oz. Price 6s. 6d.

This book, which is well printed and furnished with many well-executed illustrations, is the first volume of an appendix to the author's larger and former work "*Das schwimmende Flottenmaterial der Seemächte*," and brings the reader well up to the condition of all Powers possessing a navy. The Appendix in the volume itself deals with the Chinese Navy, even so late as 16th May, 1883.

Kriegsgeschichtliche Einzelschriften. Herausgegeben von Grossen Generalstabe. Abtheilung für Kriegsgeschichte. Heft II. Mittler. Berlin, 1883. Pp. 129. Size $9'' \times 6'' \times \frac{1}{8}''$. Weight under 10 oz. Price 2s. 6d.

Heft I of this publication was noticed in No. CXX of the Journal, and a translation of the incident of Von Boltenstern's expedition in the Loir Valley appeared in No. CXXI. The contents of the present number consist of two articles. The first is a series of extracts from the papers and reports of H.R.H. Prince Augustus of Prussia, relating chiefly to the events of the disastrous campaigns of 1806, and to those of 1813-14-15, the war of liberation, and the two invasions of France. Of special interest is the narrative of the Prince's retreat from the field of Auerstadt, until his final surrender with the remnant of the battalion which he then commanded in the neighbourhood of the town of Prenzlau, north-east of Berlin. Although it can hardly be said that he throws any new light on the circumstances of that disastrous period, those who read between the lines will still find interesting indications of the spirit which then pervaded the higher ranks of the Prussian Army, and which, combined with other influences, led to its so rapid and complete overthrow.

The Prince's remarks on the battle which took place near Bautzen, in May, 1813, may well be compared with other accounts. By this time the Prince was in active command of an infantry brigade, and had further, in August, 1808, been nominated

to the command of the Prussian artillery, and in this capacity his observations on the action of the existing artillery, more especially on the part taken in the battle of Bautzen by that of Blücher's Corps, are worthy of attention, however opposed the principles which he advocates may be to those prevailing in the present day. During the campaign of 1815 the Prince was entrusted with the reduction of the fortresses of northern France, and the number closes with his recital of the main incidents of these operations and with his remarks on siege warfare.

The second article narrates a successful attempt on the part of a French detachment to cut the railway which formed the main line of the German communications in 1870-71 in the neighbourhood of Toul by blowing up the bridge at Fontenoy on the Moselle.

The number worthily supports the object with which the publication was commenced, and may be recommended to the attention of tactical students.—B. W.

Conduct of a Contact Squadron. By Captain R. de Biensan, 3rd (French) Cuirassiers. Translated from the French by Major C. W. Bowdler Bell, 8th Hussars. Mitchell, London, and Sheldrake, Aldershot. 1883. Pp. 121. Size $8\frac{1}{2}'' \times 5\frac{1}{2}'' \times \frac{1}{2}''$. Weight under 10 oz. Price 5s.

The original of this work was noticed in No. CXIII of the *Journal*, and Major Bell, 8th Hussars, has rendered a real service to the branch to which he belongs by his translation of the above-mentioned *brochure*, by Captain de Biensan, 3rd (French) Cuirassiers.

Taking for model General Verdy's "Studies," the author has portrayed the four days' movements of a squadron despatched, on duties of reconnaissance, from one of the cavalry divisions covering an Eastern Army, advancing towards Chalons and Paris. In fact, he has epitomized one of the measures by which the 3rd Prussian Army, in August, 1870, ascertained the abandonment of the Camp of Chalons, and the move of MacMahon's forces towards Metz. The detail is very complete and the instruction ample, more especially as Major Bell has not failed to add short notes where further elucidation appeared to be necessary. We are glad to see that the author lays great stress on the necessity for a knowledge of map-reading by the non-commissioned officers of cavalry. How much more so for the Officers, and how many instances does he give when the power of rapid sketching is absolutely required from them when giving instructions to leaders of patrols and reconnoitring parties.

In the remarks under No. V of "Conclusions," we fully concur. There is but one organization for cavalry—the squadron, and the sooner we adopt it in peace, as must be the case in war, the better for the efficiency of our cavalry force. We reproduce the very words of the author:—"The squadron is a very complete unit in the hand of its leader. Its tactical and administrative organization, its numbers, equally suitable for overcoming slight resistance and for avoiding serious attacks, give it great independence."

The thanks of all who care for tactical study are due to Major Bell.—B. W.

Third Report on the Education of Officers. By the Director-General of Military Education. London, 1883. Pp. 159. Size $9\frac{1}{2}'' \times 6\frac{1}{4}'' \times \frac{1}{2}''$. Weight under 10 oz. Price 10d.

This report is far more interesting than are usually works of this character, as at the low price of a penny an ounce is furnished a report on the condition and progress of the education of the Army during the seven years 1876-82. Criticism on the policy or acts of a military department of the Army would be out of place here, so we merely commend the report to the notice of the members of the Institution, to whom it will afford many topics for thought and discussion.—L. A. H.

What to Observe and How to Report it. By Colonel Lonsdale Hale, ret. R.E., Pamph. Pp. 46. Price 6d. Sixth edition.

This pamphlet has been accepted by the authorities as an official publication, and into the text and plates have been introduced such alterations as were necessary to bring its contents into thorough conformity with the recently issued "Text-Book of Military Topography." The alterations have not in any important way affected the object the pamphlet was intended by its writer to fulfil, namely, to act as stepping-stones to further knowledge and to supply milk for those who could not digest meat. To prevent misunderstanding, it is desirable to state that the writer of the pamphlet has no pecuniary interest of any kind in its circulation.—L. A. H.

Notes on the Government Surveys of the Principal Countries. With the Civil and Military Divisions and Area of each Country, Measures of Length and Surface, Lists of Government Maps, Conventional Signs and Abbreviations employed, and useful Tables for Map-reading; to which is added a List of Colonial and Extra-Colonial Possessions and a List of Map Agents. Prepared at the Intelligence Branch, Quartermaster-General's Department, War Office, 1882. London. Printed under the Superintendence of H.M. Stationery Office. Pp. 166. Size $9\frac{1}{2}'' \times 6\frac{1}{2}'' \times \frac{3}{4}''$. Weight 1 lb. 2 oz. Price 6s.

It is very much to be regretted that the Government publishers have not the same incentives to push the sale of their publications as have private firms; for if they had, the fact of the existence of this book would then be generally known. Many of the works originating in the Intelligence Branch are necessarily of such a character that they are of interest and of use but to a few persons, but these "Notes" are invaluable to every one who may ever have to look at a foreign map or have to deal with a foreign measure. The choice of, or rather the arrangement of, the title will, it is to be feared, mislead many who, taking no interest in Government surveys, will pass by without notice a work which incidentally gives a vast mass of valuable information, of practical use to a large number of both Officers and civilians. The labour expended on collecting and preparing these "Notes" for publication must have been very great, and we are sorry that the compiler, being not officially recognized on the title-page, cannot therefore receive the credit for his work and the thanks of those who will profit by his industry. The list of colonial and extra-colonial possessions is most useful, and that of map agents includes those abroad as well as those at home.—L. A. H.

A System of Field Training. By Major C. K. Brooke, the East Yorkshire Regiment. London: Kegan Paul, Trench, and Co. 1883. Pp. 99. Size $7'' \times 5'' \times \frac{1}{2}''$. Weight 6 oz. Price 2s.

This little book was written, the author tells us, before the orders were issued dealing with the musketry training of the Army and instituting a six weeks' course of instruction for each company of infantry. Major Brooke deals fully with the field training of the arm to which he belongs—the infantry, alluding more briefly to the requirements of the other arms, "for," he writes, "it is impossible for any Officer not belonging to the arm in question to lay down in detail a course of instruction for it. To estimate truly all the wants of any one branch of the Service, it is necessary to have lived in it for some years, to have worked in it, and, if possible, to have served with it in the field. Points requiring amendment, and additions which may have become necessary, can be suggested by a careful outside observer; but a comprehensive scheme for its field training can only be worked out by one belonging to it." The foregoing statement, put forward at a time when it behoves every one interested in the better training of soldiers for field work to contribute each his mite to the elucidation of the subject, cannot be passed by without protest. It appears to us that a portion of that statement requires inversion, for the working out of a comprehensive scheme of field training for any one arm lies

perfectly within the capacity of those who know the situations on active service and on the battle-field in which that arm is found; whereas it is the inside, not the outside, observer who is the man fitted to suggest points requiring amendment and additions which may have become necessary. Major Brooke has, however, given us an excellent little work and one thoroughly of a suggestive character. He has, we hope, started rolling a literary ball which will, we trust, be kept in movement by many followers. Major Brooke declines to draw up a synopsis of a course of field instruction, because such a course would involve entering into too much detail, and further on (p. 7) he expresses his opinion that the Officer in teaching his men should not be hampered by a minute series of instructions as to how the instruction is to be imparted; but it must be remembered that to nearly all the Officers of our Army field teaching is something absolutely new, and whilst it would be contrary to the principles of sound education unnecessarily to tie the hands of an instructor, yet it is rather hard on novices in this art not to supply them at the outset of their career with such leading-strings as will show them how to walk, and so enable them eventually to dispense with their support. The list of works consulted by the author and given in Appendix G will be found very useful by those who wish to learn more of the details of the field training of soldiers.—L. A. H.

Field Artillery, its Equipment, Organization, and Tactics. By Major Sisson C. Pratt, R.A., Professor of Military History at the Royal Military Academy. Being the third volume of Military Handbooks for Officers and Non-commissioned Officers. Edited by Colonel C. B. Brackenbury, R.A., late Superintending Officer of Garrison Instruction. London: Kegan Paul, Trench, and Co. 1883. Pp. 291. Size $6\frac{3}{4}'' \times 4\frac{1}{2}'' \times 1''$. Weight under 14 oz. Price 6s.

This handbook will be found to be of great value to Officers of all arms of the Service. It is full of information; it is well written, and with the arrangement of subjects little fault can be found. Whether the same work can be a handbook for non-commissioned officers as well as for Officers may, however, be doubted. Of the contents of the books six chapters and a half are devoted to Technical Artillery, and nine chapters and a half to the Tactics of Artillery.

Whilst recommending to Officers this book for perusal, as we do most strongly, we feel bound to ask them to preserve, whilst reading the chapters on the tactics of artillery, complete independence of judgment when studying the opinions, statements, and prophecies put forward by the author.

Not even the powerful combination of the well-known editor of the handbook and of a "master of modern tactics" (Preface, p. v) should serve as an excuse to any Officer (with non-commissioned officers we are not here concerned) to accept without due consideration the tactics enumerated in this work. For practical purposes some rules and principles of action must be adopted, but tentatively only, and he will be best fitted to meet the requirements of the next campaign who is prepared at a moment's notice to modify, in order to meet hitherto unexperienced conditions, the rules and principles of the present. We heartily desire that this book may be read by all Officers, but we must be forgiven if we emphasize our foregoing remarks by calling their attention first to the bold prophecy at pp. 91-2, to the effect that "the effective range of both guns and infantry can never materially alter from the present time" to the assertion that "long-range," is a "hitherto untried species of warfare," to the extract from Liebert, in which it seems to be ignored by both quoter and quoted that it was in one of the largest armies, viz., the German, that long-range fire was first reduced to a disciplined system, and lastly to the summary treatment of a village attacked by artillery, as described at p. 245. As regards the last point it would have been more satisfactory if the author had given even one instance in which artillery have from a distance detected the second line of defence in a village, or in which good troops, *properly* posted in a village, have in modern warfare been in any way affected by the artillery fire brought to bear upon it. If, as at St. Privat, nearly 300 guns have to come into action on a village before producing a decisive moral effect on the garrison, the example certainly does not tell in favour of the power of the artillery.

As a contribution to the existing literature on tactics, and as a most valuable contribution, is this work to be regarded, but not the settlement of a most difficult question.—L. A. H.

Military Transport by Indian Railways. By David Ross, C.I.E., F.R.G.S., with map, drawings, and diagrams. Lahore, 1883. Can be obtained from Chapman and Hall, London. Pp. 109. Size $9'' \times 5\frac{1}{2}'' \times \frac{3}{4}''$. Weight under 1 lb. $1\frac{1}{2}$ oz. Price 8s.

The author superintended, during the late war in Afghanistan, in 1878-81, the arrangements for the despatch of troops of all arms, as well as that of military stores, by the Sindh, Punjab, and Delhi Railway; and the results of his experience during that period were set forth by him in a lecture, delivered at the United Service Institution of India at Simla. That lecture is now issued in a condensed form; various reports on the question of military transport by Indian railways, which have been submitted from time to time, have also been revised and embodied, and the whole, comprising all the available information on this most important and interesting subject, is now published in this book, dedicated by permission to the Commander-in-Chief in India. The extent to which railway transport was used in that campaign may be estimated from the fact that the gross military traffic booked under Government warrants during the Afghan War was, so the author tells us—

538,364 troops and followers.
 114,156 horses, ponies, and mules.
 15,477 bullocks.
 8,654 camels.
 479 guns, artillery and engineers' carriages.
 148,889 tons of commissariat, ordnance, and military stores.
 93,099 tons of material for the frontier railways.

Requiring an estimated number of 2,023 trains, 785 of which were special troop, live stock, and material trains.

The weight of stores despatched only represents the quantity booked under Government warrants, and as the greater portion of commissariat supplies were sent by traders, these figures only show a small proportion of what was actually forwarded by rail.

On the other hand, the number of troops and followers conveyed seems very high, but this arises from each separate despatch of troops being reckoned as a fresh departure. Thus a number of regiments were concentrated at various places in the first instance, and remained there for a few weeks before proceeding to the front; these troops, of course, are reckoned twice, and often three times. Each despatch involved nearly the same amount of work, with the exception of haulage, to the railway authorities, as if the regiments had gone at first right through to their destination, that is, so far as collecting stock, embarking and disembarking, and arranging time tables were concerned. For some time there were about sixty trains entering and leaving the Lahore station daily, which will give an idea of the heavy work that had to be conducted, and this on single lines of railway.

Mr. Ross's book is full of valuable information, and is a welcome contribution to the literature which deals with one of the most difficult branches of military administration.—L. A. H.

The Development of Armour for Naval Use. By Lieutenant E. W. Very, U.S.N. Trübner and Co., Ludgate Hill, 1883. Pp. 243. Size $9\frac{1}{2}'' \times 6\frac{1}{4}'' \times \frac{3}{4}''$. Weight 1 lb. $3\frac{1}{2}$ oz. Price 7s. 6d.

The book appears to be a reprint of a paper in the "Proceedings of the United States Naval Institute," vol. ix, 1883, which are published quarterly by the Institute.

In the first chapter he discusses in a practical way the principles which should govern artillery attack of armour—mainly dealing with the question of relative advantages of “racking” and “punching”—and without attempting to look at them from a scientific point of view.

In the second chapter he deals with the introduction and development of iron armour for ships during the “smooth-bore” period in Europe, and he properly gives France the credit of turning out the first ironclad squadron—that which attacked Kinburn in 1855—though he proves that his own countryman, Robert Stevens, gave the first practical impulse to the adoption of armoured ships in Europe by being first in the field with the designs of a steam armoured war-vessel. For some unaccountable reason the United States did not at that time take up the idea.

In a similar way he argues that though Ericsson and Cowper Coles were close together in their ideas about low freeboard vessels with armoured turrets, yet the priority of design of such ships belongs to Ericsson because he *float*ed the first vessel with a *revolving* turret though she was *not a seagoing ship*. Cowper Coles he admits was first in laying down the keel of a ship with a revolving turret, and certainly launched the first *seagoing* turreted ironclad.

On the other hand Lieutenant Very says that before Ericsson had submitted his design of a monitor to the Naval Commission, Captain Cowper Coles had demonstrated in public the advantages of the turret mounted on low freeboard ironclad hulls, and he takes pains to correct a very general impression amongst Americans that the introduction of the ironclad was principally due to the steps taken by the United States in creating a fleet at the outbreak of the Civil War. He points out how that in spite of the valuable experience gained in the actions between monitors and forts in that war, and in experiments abroad, the improvement of armour was neglected in his country, and what was even worse, the introduction of rifled guns was withheld long after the immense inferiority of smooth-bores for the attack of armour had been clearly demonstrated.

In another part he reads us a lesson on our unaccountable slowness to adopt breech-loading and to improve the manufacture of our gunpowder by which in recent years England has been allowed to fall behind other Powers in respect of the attack of armour, when we might easily, and ought to, have kept a clear lead.

Lieutenant Very has carefully studied the results gained from the armour-plate experiments at Shoeburyness, and in Europe generally, and follows with intelligence the successive steps taken with new kinds of armour, such as steel, compound (steel and iron) plates, and massive chilled cast-iron armour.

In a few cases the author has fallen into error in dealing with the results of European trials; for instance, when at page 449 he infers the superiority of the Prussian method of artillery development over that of Woolwich from the result of a shot fired in 1879 at Meppen; for the target used on that occasion was made of such inferior material, and was so badly put together, that it was altogether unreliable for the purposes of the conclusions attempted to be drawn from the trial. He also gives some account of the processes of manufacture by which these materials have been produced in Europe.

In the concluding chapter of his paper Lieutenant Very also gives a brief account of the various formulæ which have been used in calculating the resisting power of armour. These apply only to wrought-iron armour, as it has not yet been found practically possible to reduce to law the action of projectiles on hard steel and cast-iron armour.

To those who may wish to take up afresh the subject of armour-plating, especially that for naval purposes, Lieutenant Very's paper will prove an exceedingly useful and instructive guide, while for those who may be already well acquainted with the subject and professionally interested in it, the paper will be found to contain much that will render it a convenient work of reference.—T. I.

Hints to Courts-Martial, Confirming and Commanding Officers upon many matters usually coming under their notice. By J. C. O'Dowd, of the Middle Temple, Barrister-at-Law. Deputy-Judge-Advocate-General of the Forces. Second Edition. London: Clowes and Son. 1882. Pp. 167. Size 7" x 5 x $\frac{1}{2}$ ". Weight under 10 oz. Price 4s. 6d.

The official position held by the author of this work places the book on a platform distinct from those occupied by amateur lawyers, although the author expressly states that it is altogether unofficial. Mr. O'Dowd says in his Preface to the First Edition: "For several years before the passing of the Army Act, 1881, Military Law was in a transition state. Changes were either imminent or in process of embodiment. That fact prevented any previous attempt on my part to fulfil the main object of this work, viz., the publication in a brief, popular, and easily intelligible shape, of something in the nature of a digest of authoritative opinions upon the various questions that commonly come to be dealt with by courts-martial. These opinions have the character and weight of judicial decisions. But unlike the judgments of the ordinary tribunals, which interpret, and in a certain sense make the law, they are communicated to nobody but the persons connected with the particular case dealt with at the moment. Whatever value they may possess in the way of guidance and precedent is thus to a great extent lost. In the following pages I have summarised and applied generally many of these rulings, accompanied with remarks applicable to the administration of Military Law. The work is not intended to be an exact or exhaustive treatise. . . . I hope that, when read together with the penal sections of the Army Act, 1881, and the new Rules of Procedure, it will be found to meet in a practical way probably nineteen out of twenty of the points arising in ordinary course before a court-martial." The second edition is the original work generally revised with some slight additions.—L. A. H.

Military Law; its Procedure and Practice. By Major Sisson C. Pratt, R.A., Professor of Military History at the Royal Military Academy, being the Fifth Volume of Military Handbooks for Officers and Non-Commissioned Officers, edited by Colonel C. B. BRACKENBURY, R.A., late Superintending Officer of Garrison Instruction. London: Kegan Paul, Trench. 1883. Pp. 225. Size 6 $\frac{3}{4}$ x 4 $\frac{3}{4}$ x $\frac{1}{2}$ ". Weight under 10 oz. Price 4s. 6d.

Colonel Brackenbury in his Preface states that this book has been compiled by an acknowledged authority on the subject, in order to aid Officers and non-commissioned officers in overcoming the many difficulties which attend the study of the legal part of their profession; it must be looked upon as an aid to, and not as a substitute for, the ordinary legal military code; the method of arrangement is somewhat novel, and will, it is hoped, be found to have the merits of simplicity and ease of reference. The author himself in a note informs us that after a considerable portion of the book was written the "Official Manual of Military Law" was provisionally issued, and he has had the advantage of deriving from it the most recent authoritative decisions on disputed points. Colonel Parsons, Deputy-Judge-Advocate, has also assisted in revising the proof sheets of this work.

This book, coming forward under the ægis of the authorities above-named, stands therefore a little aside from the ruck of publications on Military Law with which we are now deluged, but we understand that Colonel Parsons is in no way responsible for the conclusions or statements of the author, although he has aided him on certain points. It is, however, enough to make the late Sir Charles Napier turn in his grave to find non-commissioned officers aided in their "study of the legal part of their profession."—L. A. H.

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The Journal

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1884.

APPENDIX.

PROCEEDINGS OF THE FIFTY-THIRD ANNIVERSARY MEETING.

THE FIFTY-THIRD ANNIVERSARY MEETING of the Members was held in the Theatre of the Institution on Saturday, March 1st, 1884.

ADMIRAL SIR ASTLEY COOPER KEY, G.C.B., A.D.C., F.R.S., FIRST NAVAL LORD, IN THE CHAIR.

I. The Secretary read the Notice convening the Meeting.

II. The Fifty-third Annual Report was read as follows:—

1. The Council have the pleasure of submitting their FIFTY-THIRD Annual Report.

MEMBERS.

2. Sixty-eight Life Members and One hundred and thirty-seven Annual Subscribers, making a total of Two hundred and five new Members, joined the Institution during the past year. The loss by death amounted to Sixty-seven, and Seventy-seven Members withdrew their names, whilst the names of Twenty-five have been struck off the list in consequence of the non-payment of their subscriptions, after frequent applications. The increase therefore is Thirty-six.

STATEMENT OF CHANGES AMONG THE MEMBERS SINCE 1ST JANUARY, 1883.

	Life.	Annual.
Number of Members, 31st December, 1882 ..	1,349	3,242
„ „ joined during 1883 ..	68	137
	<u>1,417</u>	<u>3,379</u>
Changed from Annual to Life	+ 9	-
	<u>1,426</u>	

	Life.	Annual.
Deduct—Deaths during 1883 ..	17	50
Withdrawals ..	—	77
Struck off ..	—	25
	<u>17</u>	<u>152</u>

Number of Members on 1st January, 1884 ..

A tabular analysis of the present and past is given in the Appendix, page 7.

FINANCE.

3. An Abstract of the Accounts for the year following page.

ESTIMATE OF RECEIPTS AND EXPENDITURE FOR THE YEAR 1884.

EXPENDITURE.				RECEIPTS.			
	£	s.	d.		£	s.	d.
Secretary's Salary and Lodging allowance	400	-	-	Balance at Bankers, 31st Dec., 1883	135	-	-
Librarian's Salary	160	-	-	Annual Subscriptions :			
Clerk's do.	71	-	-	£ s. d.			
Servants' Wages	530	-	-	At 10s.	170	-	-
Ditto Clothing	75	-	-	Above 10s. 2,700			
Insurance	23	-	-		2,870	-	-
Ground Rent	205	-	-	Entrance Fees	200	-	-
Fuel	60	-	-	Dividends and Interest on			
Lighting	60	-	-	Exchequer Bills	481	-	-
Assessed and Income Taxes	85	-	-	Government Grant	600	-	-
Parish and Water Rates	120	-	-	Sale of Journals	170	-	-
Artificers, Repairs, &c. ..	200	-	-				
Museum	50	-	-				
Gold Medal	12	-	-				
Library and Topographical							
Departments	250	-	-				
Advertisements	100	-	-				
Printing Circulars & Stationery	150	-	-				
Maps, Diagrams, &c., for							
Lectures	50	-	-				
Journals, including Printing Annual Report and							
List of Members	1,400	-	-				
Postage of Journals	200	-	-				
Postage	30	-	-				
House Expenses and Sundries	80	-	-				
Balance	145	-	-				
Total	£4,456	-	-	Total	£4,456	-	-

LIFE SUBSCRIPTIONS AND CAPITAL ACCOUNTS.

4. Life Subscriptions to the amount of £1,200 carried over from 1882, have been invested in No. 1 Consols, producing £1,183 3s. 10d., thus raising the fund of the Institution to £15,251 15s. 4d. on the 1st January 1884.

THE FUTURE LOCALITY OF THE INSTITUTION.

5. Arrangements for the appropriation of the immediate neighbourhood of the Institution. The Council have written to the Chairman of the Local Board of Health in view to ascertaining the intentions of the Local Board for the future of the Institution. A report on the subject shall receive careful consideration.

PAPERS;

6. Papers on the following subjects were read and discussed during the year, viz.:—

LIEUT. C. SLEEMAN, late R.N. "The Lay and other Locomotive Torpedoes considered for the purpose of Coast Defence, and also as the Armament of Ships, Torpedo and Submarine Boats."

SIR SAMUEL WHITE BAKER, M.A., F.R.S., &c. 1. "Cyprus as a Naval and Military Strategical Position." 2. "Steel Bullet-proof Cart Shield for the Protection of Field Batteries."

CAPTAIN J. C. R. COLOMB, F.S.S., F.R.G.S. "The Use and Application of the Marines, past, present, and future."

NATHANIEL BARNABY, Esq., C.B., Director of Naval Construction, Admiralty. "On Battle-Ships."

CAPTAIN N. L. WALFORD, R.A. "The Effects of the Bombardment of the Forts of Alexandria, and the lessons to be learnt therefrom." (2 lectures.)

LIEUT. G. HAMILTON, 14th Hussars. "Mounted Marksmen and the Dismounted Service of Cavalry."

LIEUT.-COL. C. E. WEBBER, C.B., R.E. "Suggestions as to the Transport of the Future."

MAJOR C. J. EDWARDS, 2nd West York Yeomanry Cavalry. "The Yeomanry Cavalry considered as an Auxiliary Reserve Force."

SIR FREDERICK A. ABEL, Kt., C.B., F.R.S., &c., &c. "The most recent Progress in the Production and Application of Explosive Compounds."

MAJOR-GENERAL J. W. LAURIE, late Deputy Adjutant-General of Militia, Canada. "The Protection of our Naval base in the North Pacific."

LIEUTENANT R. S. LOWRY, R.N., H.M.S. "Espiegle." "Coaling Ships or Squadrons on the open sea."

MR. EMILIUS CLAYTON, R.A. "The Russo-Turkish Frontier in Asia Minor."

MR. R. H. HARRIS, R.N. "Maritime Power and its Probable Employment in War."

MR. C. B. BRACKENBURY, R.A., Superintendent, Royal Gunpowder Factory, Waltham Abbey. "The Latest Development of the Tactics of the Three Musketeers."

MR. H. U. NOEL, R.N. "The Masting of Ships of War, and the Possibility of still Employing Sail-power in Ocean-going Ships."

MR. J. WALKER, Commanding 3rd Battalion Royal Scots Fusiliers. "The Training of the Militia."

MR. J. W. WALKER, Esq., Scots Guards. "Military Ballooning."

MR. B. P. NUGENT, K.C.B., R.E. "Harbours of Refuge in the subject of Convict Labour."

MR. J. W. WALKER, R.N. "Machine Guns."

MR. J. W. WALKER, M.D., F.R.S., Professor of Military Hygiene, Army Medical School. "Military Hygiene."

MR. J. W. WALKER, R.N. "Magazine Rifles and Repeaters."

The following are due to the authors of the above papers, in connection with the discussion on professional subjects con-

LIBRARY

7. The Library now contains 20,658 volumes, of which Three hundred and six have been added since the last Report; one hundred and five having been purchased and the remainder presented.

Donations of books and maps have been received from the Governments of Austria, Brazil, Denmark, France, Germany, Italy, the Netherlands, Russia, Spain, Sweden, Switzerland and the United States.

The thanks of the Council have been conveyed to the several Governments for these donations.

The Institution is indebted to the Lords Commissioners of the Admiralty, and to the Secretaries of State for War and India, for copies of various works issued by their departments.

The exchange of Journals with Foreign Governments and with many Scientific Societies, in this and other countries, has been continued.

MUSEUM.

8. A list of the additions to the Museum and Library will be found in the "Proceedings" of this day's meeting, and in the Appendix to Vol. XXVII. of the Journal.

PROPOSED ALTERATION IN THE BYE-LAWS.

9. At the end of Section IV. para. 4, it is proposed to add the following words, viz., "Any Member of the Council appointed to a tour of service abroad shall be considered as vacating his seat at the Council."

VICE-PATRON.

10. The Council regret to record the death of Major the Rt. Hon. William Beresford, a Vice-Patron of the Institution. Major Beresford became a Member of the Institution in 1852, when Secretary and was elected a Vice-Patron the same year.

VICE-PRESIDENT.

11. The Council also regret to record the death of Richard Collinson, K.C.B., a Vice-President of the Institution. Richard Collinson was one of the Original Members of the Institution and was elected a Member of Council in 1858, and re-elected in 1870.

The Council have had the pleasure of electing Sir Beauchamp Walker, K.C.B., Director General of the Ordnance, Vice-President. Sir Beauchamp Walker has been elected Vice-Chairman of the Council, of which he has been a Member.

CORRESPONDING MEMBERS.

12. On the 1st January, 1884, the total number of Members of Council was 251.

GOLD MEDAL.

13. Seven Essays were received in competition for the Gold Medal, the subject being—

“On an outbreak of War, what is the best organization for distributing the *personnel* of the Navy and of the Reserves among the available War vessels, and among a proportion of Merchant vessels as an Auxiliary to the Navy?”

Admirals A. P. Ryder and Sir Leopold McClintock, and Captain W. Arthur, C.B., R.N., kindly undertook the duties of referees. Their decision will be made known to this Meeting.

The subject for the Military Essay for this year is—

“Should the European Army in India continue as at present constituted, or should it be converted in whole or in part into a local force?”

The competition is open to Members of the Institution, and to all who are eligible to become Members.

14. The following Members retire by seniority of service on the Council, viz. :—

Commander SYDNEY M. EARDLEY WILMOT, R.N.	Lieut.-Colonel S. J. NICHOLSON, R.A., Assistant to the Director of Artillery and Stores.
Lieut.-Colonel D. MILNE HOME, M.P., Royal Horse Guards.	Colonel H. SCHAW, R.E., Deputy Director of Works for Fortifications.
Lieut.-General Sir EDWARD HAMLEY, K.C.B., &c., &c.	Lt.-General Lord CHELMSFORD, G.C.B.
Rear-Admiral Sir WILLIAM HEWETT, V.C., K.C.B., &c., &c.	Lt.-General Sir ARTHUR J. HERBERT, K.C.B., Quarter-Master General.

The Council submit the names of ten Members, from which vacancies may be filled up. The first eight on the list are proposed for immediate election, viz. :—

Lieut.-Colonel D. MILNE HOME, M.P., Royal Horse Guards.	} For re-election.
Lieut.-General Lord CHELMSFORD, G.C.B.	
Lieut.-General Sir ARTHUR J. HERBERT, K.C.B.	
Rear-Admiral Sir F. LEOPOLD MCCLINTOCK, Kt., F.R.S.	} For immediate election.
Admiral A. P. RYDER.	
Lieut.-General Sir A. COOPER KEY, G.C.B., F.R.S., &c., &c.	
Lieut.-Colonel A. HALE, R.E. (retired).	
Lieut.-Colonel G. GREVILLE, Grenadier Guards.	
Lieut.-Colonel H. SAY BRINE, R.N.	
Lieut.-Colonel W. SEYMOUR, Coldstream Guards.	

CONCLUSION.

The Council point with satisfaction to the increase in members, and to the sound financial condition of the

By Order,

B. BURGESS, CAPTAIN,

Secretary.

APPENDIX.—TABULAR ANALYSIS OF THE STATE OF THE INSTITUTION
To 31st of December, 1883.

Year. 1st Jan. to 31st Dec.	Annual Subs. received.	En- trance Fees.	Income (from all sources).	Life Subs. received.	Amount of Stock.	Invested in the pur- chase of Books, &c.	No. of Vols. in Library.	No. of Members on the 31st Dec.	Number of Visitors.
£	£	£	£	£	£	£			
1831	654	..	654	1,194	..	..	..	1,437	..
1832	1,146	..	1,146	973	..	..	..	2,699	..
1833	1,405	..	1,450	692	..	..	..	3,341	..
1834	1,500	..	1,549	583	1,100	..	..	3,748	13,376
1835	1,480	..	1,574	366	2,430	40	..	4,155	8,537
1836	1,570	..	1,682	330	3,747	45	..	4,069	8,521
1837	1,549	..	1,747	222	4,747	180	..	4,164	10,907
1838	1,462	..	1,634	230	5,500	246	..	4,175	15,788
1839	1,399	..	1,565	168	5,500	292	..	4,186	16,248
1840	1,363	..	1,525	198	5,500	446	5,500	4,257	17,120
1841	1,450	..	1,643	186	6,000	243	5,850	4,243	19,421
1842	1,373	..	1,565	144	6,400	373	6,450	4,127	21,552
1843	1,299	..	1,494	140	6,700	237	7,000	4,078	27,056
1844	1,274	..	1,408	112	3,000	298	7,850	3,968	22,767
1845	1,313	..	1,466	228	1,500	127	8,100	3,988	21,627
1846	1,298	..	1,456	138	1,500	74	8,410	4,031	32,885
1847	1,314	74	1,502	132	1,700	37	..	4,017	38,699
1848	1,175	57	1,375	48	1,700	85	9,641	3,947	37,140
1849	1,176	72	1,375	84	1,150	58	..	3,970	33,333
1850	1,141	106	1,294	198	600	36	..	3,998	33,773
1851	1,136	131	1,292	66	666	34	10,150	3,188	52,173
1852	1,134	133	1,281	114	200	43	10,300	3,078	20,609
1853	1,243	319	1,634	264	528	41	10,420	3,251	25,952
1854	1,200	138	1,368	126	612	95	10,587	3,171	22,661
1855	1,159	107	1,289	120	653	55	10,780	3,131	14,778
1856	1,216	197	1,519	156	761	47	10,832	3,204	16,184
1857	1,258	176	1,937	78	1,038	40	10,960	3,168	12,755
1858	1,318	221	2,102	105	438	31	11,062	3,246	25,750
1859	1,526	195	2,277	512	946	70	11,320	3,344	28,600
1860	1,961	298	3,577	397	2,178	114	11,517	3,518	29,600
1861	2,122	305	2,899	266	2,846	99	11,812	3,689	30,600
1862	2,296	242	3,127	239	3,178	109	12,026	3,797	31,600
1863	2,379	218	3,100	405	3,583	143	12,296	3,840	32,600
1864	2,425	215	3,253	222	4,516	116	12,700	3,900	33,600
1865	2,435	154	3,467	235	4,804	137	13,000	4,000	34,600
1866	2,435	157	3,488	299	5,486	150	13,337	4,100	35,600
1867	2,431	141	3,467	208	5,732	140	13,800	4,200	36,600
1868	2,446	184	3,534	297	6,396	119	14,100	4,300	37,600
1869	2,368	165	3,485	238	6,653	232	14,600	4,400	38,600
1870	2,376	178	3,493	333	7,313	140	15,000	4,500	39,600
1871	2,455	237	3,677	538	7,748	202	15,400	4,600	40,600
1872	2,620	336	4,111	713	8,927	192	15,800	4,700	41,600
1873	2,776	295	4,316	535	9,465	222	16,200	4,800	42,600
1874	2,819	216	4,491	409	10,189	218	16,600	4,900	43,600
1875	2,801	154	4,595*	469	10,721	200	17,000	5,000	44,600
1876	2,794	162	4,500	437	11,305	200	17,400	5,100	45,600
1877	2,840	218	4,750	526	11,725	200	17,800	5,200	46,600
1878	2,881	231	4,700	459	12,091	200	18,200	5,300	47,600
1879	2,904	180	4,490	407	12,505	200	18,600	5,400	48,600
1880	2,962	255	5,115*	577	12,960	200	19,000	5,500	49,600
1881	2,893	238	4,967	645	13,380	200	19,400	5,600	50,600
1882	2,829	181	4,739	491	13,800	200	19,800	5,700	51,600
1883	2,892	205	5,023	692	14,220	200	20,200	5,800	52,600

* A legacy of £10

III. Admiral the Right Hon. SIR JOHN C. DALRYMPLE HAY, Bt., M.P.:—

Sir Cooper Key, my Lords and Gentlemen,—The Report which has just been read by the Secretary is a very satisfactory one, and so much the more so that there is very little to call attention to. The whole of it is summed up in the conclusion, in which “the Council point with satisfaction to the increase in the number of the Members, and to the sound financial condition of the Institution.” I may, however, be permitted to say, that the increase in the numbers, although not so great as has occasionally taken place, is a satisfactory addition, and shows the manner in which the Institution is valued by the Members of both Professions. The funds are increasing, and the fact that the funded property of the Institution is over £15,000 is very satisfactory, and is, I think, very creditable to those who look after our financial condition. It is the more satisfactory, because the letter to the Chancellor of the Exchequer, which has been answered, points to the fact, that before long it is possible we may have the question before us of the new building, either on this site, or of some other arrangement by which this Institution, which has been of so great benefit to the nation generally, may acquire a sufficient and satisfactory habitation to carry out the useful work in which it is engaged. The increase to the Library of 306 volumes is also most pleasing to contemplate. As we know, that our Library contains no books which any one would wish to discard, and as it is recognised all through Europe as, for its purpose, the best Library that has ever been collected, one is glad to see it increasing in strength, and I trust it may long continue to do so. The names of the Referees will, I am sure, give satisfaction, as we can rely upon their judgment; and I am also sure that I am but expressing the general satisfaction of the Members of the Institution at the bestowal of the medal, which is an inducement to the officers of both Services to study, and to give to the world the results of those studies, which are so advantageous both to the Services and to the country. The death of one of the Vice-Presidents, Sir Richard Collinson, deserves more than a passing notice. My first acquaintance with him was in the year 1835 or 1836, therefore I may say he has been a very old friend of mine. He was then a very young officer, and had distinguished himself beyond measure in saving the lives of the men of the Chilian ship of war, “Monteaguado,” which was shipwrecked in the Bay of Valparaiso. From that day forward I have watched his career with interest, and have served with him in many parts of the world. His services are known to this Institution, and I am sure the Trinity Board have lost a member from whom the Merchant Service, as well as the Navy, highly valued. I have much pleasure in congratulating the Institution and the Vice-Presidents, of whom it is to be one, upon the accession to our number of the gallant General, Sir Andrew Walker. We welcome him here, and I am sure the Institution will value his services as Vice-President will be invaluable. There is little more for me to say, as I know that my gallant friend, Sir Andrew Clarke, is about to be elected. I will leave him to supply any remarks that I have omitted.

General Sir ANDREW CLARKE, R.E.:—

The compliment which my gallant friend has paid me, by saying that I had said everything that I could have said, I should be wasting time to than formally second the adoption of this Report.

He was then put from the Chair, and was carried

RES:—

men,—The Resolution which I have to propose is, that the members of Council who retire by rotation be elected to fill vacancies:—

P., Royal Horse Guards G.C.B. BERT, K.C.B.	}	For re-election.
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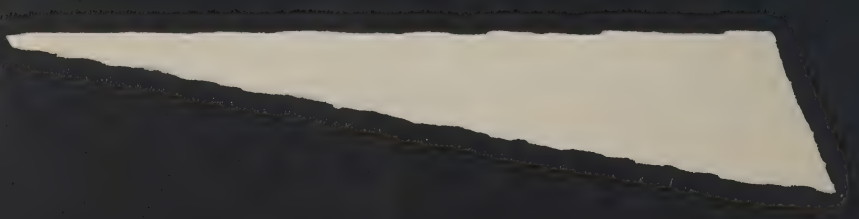
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IV. Admiral GORE-JONES

Mr. Chairman and Gentlemen
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Lt.-Colonel D. MILNE HOME, M.P.
Lieut.-General Lord CHELMSFORD,
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GENERAL ABSTRACT OF

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Librarian's Salary...	...
Clerk's Salary	...
Servants' Wages	...
Ditto Clothing...	...
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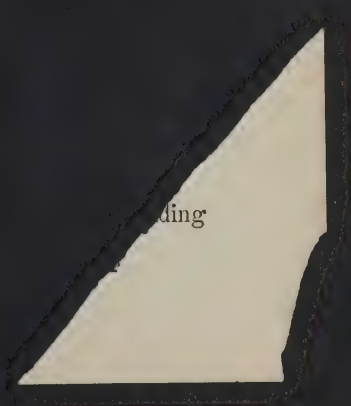
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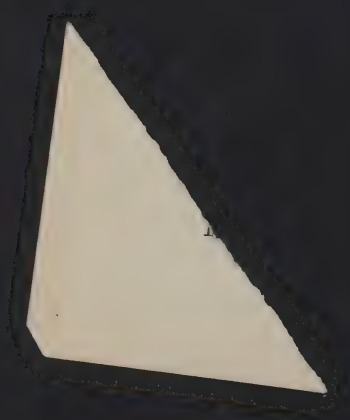
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Vice-Admiral Sir F. LEOPOLD McCLINTOCK, Kt., F.R.S.	} For immediate election.
Admiral A. P. RYDER.	
Admiral Sir A. COOPER KEY, G.C.B., F.R.S., &c., &c.	
Colonel LONSDALE A. HALE, R.E. (retired).	
Colonel CLIVE, Grenadier Guards.	

and that the following names of members be adopted from which to select, in case of vacancies occurring in the Council, viz. :—

Captain LINDESAY BRINE, R.N.
Colonel Lord WILLIAM SEYMOUR, Coldstream Guards."

In proposing these names, I am sure it is quite unnecessary for me to say very much. They are all good men and true; they are all fitted by long experience to assume the place that they are now being appointed to in the Council. From their well-known abilities they will without doubt be our counsellors, our guides, and I am sure they will be our friends; and therefore I have very much pleasure in proposing their names.

The Resolution having been seconded by Captain J. C. R. COLOMB, was put from the Chair, and was carried unanimously.

V. Dr. CRAWFORD, Director-General of the Medical Department of the Army :—

Mr. Chairman and Gentlemen,—I have much pleasure in proposing "That the thanks of this meeting be given to the Auditors for their valuable services, and that the following gentlemen be elected Auditors for the ensuing year :—Lieut.-Colonel E. R. Wethered, E. R. Raitt, Esq., and Tobias G. Ridgway, Esq." It is only necessary to call attention to the very satisfactory state of our finances to show that at all events our auditors have well done their duty in the past, and as I am sure they will perform those duties with equal satisfaction to the Institution in the future, I shall not trouble you with any further observations, but shall ask you to carry this Resolution as you have done those which have been already passed, without any dissentients. I am sure there will be no dissentients from the vote of thanks which is now before you.

Captain S. LONG, R.N. :—

I have the honour to second the Motion so ably brought before you by the Director-General of the Medical Department. We are all very much indebted to the Auditors of this Institution, and perhaps it may not be out of place while speaking of their services, to call attention to what I believe to be an important feature in the value of an Institution like this. The misfortune of death is never so conspicuously shown as when an officer, who by his abilities and opportunities in his career is evidently well fitted by nature to leave a legacy of wisdom to his successors, is called away without having been able to record his opinions on matters which affect the interests of the Service. I am glad to see from the Report that that view is obtaining more and more, and I hope that that day will never arrive when this Institution will cease to be to the intellectual life of the Service what the mind is to the body, that is to say, the means of distributing that information, and of fostering that discussion which appears to be its reason *d'être*. I have the honour to second the Resolution.

The Resolution was then put from the Chair and was carried unanimously.

VI. The Report of the Referees having been read by the Secretary, it was found that the winner of the Gold Medal was Captain Charles Johnstone, late H.M.S. *Dryad*, and the Essays of Commander Kingscote, Captain R. H. Harris, and Captain H. Cleveland, R.N., were honourably mentioned; the Essay of the latter was recommended to be printed.

The CHAIRMAN :—

You are all aware, perhaps, that when Captain Johnstone wrote this Essay he was a Commander, but as you are also perfectly aware he has been promoted for his services at Madagascar, which have won for him the esteem, regard, and admiration of everybody connected with the Service. It must be a great satisfaction to find a man serving as he has done, and occupying the position he has occupied, writing an essay on this subject that gains the Gold Medal. I do not know anything more satisfactory to the whole Service. I am pleased to say he is now at Suakin with his ship's company. I presume that the Council or the Secretary will convey to these officers who have been honourably mentioned the estimation in which their Essays have been held.

Lieut.-General Lord CHELMSFORD, G.C.B. :—

Mr. Chairman and Gentlemen,—The Resolution which has been placed in my hands is, "That a vote of thanks be given to the Referees, Admiral A. P. Ryder, Admiral Sir Leopold McClintock, and Captain W. Arthur, C.B., R.N., for their valuable services in adjudicating on the Naval Prize Essay." I am certain that no words of mine are required to allow that Resolution to be passed unanimously. Everyone attending this Meeting to-day must be well aware what a difficult task it is to adjudicate in a matter of this sort—the actual time which is required to weigh carefully the several Essays which are placed in their hands to be considered, and then after that, the difficulty of apportioning the relative value of those Essays in each individual case. I am certain that the Meeting will agree with me that the Referees could not have been chosen more judiciously, and we are absolutely certain that the Prize Essay which has been selected is the one which really had the best relative merit. I may be allowed, before moving the Resolution, to say I think it is very satisfactory that out of the number of seven there should have been four (including the Prize Essay) honourably mentioned. It reflects very great credit, indeed, upon those who endeavoured to obtain the medal. I beg to move the Resolution which I have just now read.

The Resolution, having been seconded by Admiral Luard, was carried unanimously.

Vice-Admiral Sir LEOPOLD MCCLINTOCK :—

Mr. Chairman and Gentlemen,—In the absence of my colleagues I think it my duty to express what I am sure is their feeling, and certainly my own, that it has given us a very great pleasure to be of use in this matter to the Council. We have had given us a great deal of work to go through all these Essays, and really to select the No. 1 amongst a difficult set; but it has been a work of very great satisfaction to us to go over the intelligences of our junior brother officers, I may call them younger officers, and gent labouring at it with a feeling of complete satisfaction that there are such men, of we retire from the Service and enthusiasm, for the Service, alive in it and growing up in it, such intelligent officers will in due time more than fill our places. and that those officers will in due time more than fill our places.

Sir BEAUCHAMP WALKER :—

Lieut.-General Sir Beauchamp Walker do more than read the following Resolution and propose it. It really need hardly be said that, occasionally, the Members of our Council proceed on was called forth by the vacancies—there being no law to the effect of the Resolution foreign service, and their places—have not been filled for a considerable time. We are I am now about to propose to the Council up to the full number, and to admit those generally anxious to keep the Council provisionally, are waiting for admission. It was, tlemen who, having been elected Members of the Council, and adopted unanimously, after therefore, proposed at a meeting, the following addition be made to Section IV., para. 4, some little discussion, that the Member of the Council appointed to a tour of of the bye-laws, namely, that "Any Member vacating his seat at the Council."

The Resolution, having been seconded by Admiral Sir Frederick Nicolson, was unanimously carried.

The CHAIRMAN having announced that the business of the Meeting was concluded, vacated the Chair, which was taken by Sir BEAUCHAMP WALKER, the Chairman of the Council.

Colonel MILNE HOME, M.P.:—

My Lords and Gentlemen,—I am very much pleased indeed, as a soldier, to have been requested by my fellow members of the Council to have the honour of moving a vote of thanks to the distinguished sailor who has presided over our gathering to-day. You are all aware that Sir Cooper Key has come here as second in command of the Admiralty instead of Lord Northbrook. We no doubt regret the absence of Lord Northbrook himself, but we have on previous occasions had evidence of his lordship's great interest in the proceedings of this Institution, and therefore we may be still more pleased to have the second in command at present with us to-day. We are entering upon what may be a rather critical year in the history of the Royal United Service Institution, and I for one, and the Council all hope that the Chairman to-day will be able to take across the street a very good report of the progress of the Institution to Lord Northbrook. It is not at all impossible that some re-arrangements of our site may take place in the course of the year, as it is well known that several houses in this neighbourhood are to be pulled down for metropolitan improvements, and I cannot help feeling convinced of this, that if the representatives of the two Services at the Admiralty, and at the War Office, represent our interests to Her Majesty's Government, they will be pleased to give whatever countenance they can to this Institution. I think it is also satisfactory for us to know that the present Chancellor of the Exchequer, when he was presiding at the War Office, expressed the very deepest interest in us, and I am convinced, from personal communication with him, that he will still, in his present capacity do all that he can to help us in every possible way. Without further considering, I beg to move, "That the thanks of this Meeting be given to Admiral Sir Astley Cooper Key for having taken the Chair."

Admiral Sir FREDERICK NICOLSON:—

I have much pleasure in rising to second the Resolution. Colonel Milne Home has touched upon all the points that are interesting to us with regard to the Institution, and as to the gallant officer who has taken the Chair, he is a great deal well known, both in the service and out of it, for it to be necessary for me to say anything further.

The Resolution was carried unanimously.

Sir ASTLEY COOPER KEY:—

I beg to acknowledge most warmly the thanks of the Meeting for the honour and easy duty that I have been able to perform. I much regret that the second of the Admiralty has not been able to occupy the Chair to-day. I am sure to express to you his great regret that he is at present unable to do so, and I imagine, to make engagements beforehand, his public duties will be in conflict with his private engagements. He expressed to me this morning his great interest in the success of the Institution, and his personal interest in it, I trust that it does not require any special mention. I have always held the work done at this Institution in the highest esteem, and I know which portion of the work can be considered the most valuable, the papers, and discussions on them, or the encouragement given to officers on professional subjects. I cannot speak too highly of the gold medal given as a prize for the best essay, and the encouragement of the sister Service, as well as of our own, has led to the selection of leading officers to a thoughtful study of the subject, and an essay, for which Captain Johnstone has just been awarded the gold medal, the difficulty, viz., "to determine on an outline of the history of the Institution."

buting the *personnel* of the Navy and of the Reserves among the available war vessels, and among a proportion of merchant vessels as an auxiliary to the Navy?" During the last year or two, we have been engaged, at the Admiralty specially, with this most important subject. The fact that Captain Johnstone, while he was engaged in delicate and onerous duties at Madagascar, requiring much judgment and firmness, was also able to give his mind to so complicated a question, and to write an essay which has gained the gold medal, must, I think, raise him very much in the opinion of Members of both Professions. I would call attention to what is not often mentioned in this Institution, the number of Occasional Papers that appear in the "Journal," in addition to the lectures and discussions. Many of them are of interest and of much value. I hope that I have been able to make arrangements for the Journal of the Institution being distributed to the seamen's libraries. In view of the great professional interest of the matter contained in these Journals, it is desirable that everybody in the ships, officers and men, should have the opportunity of reading them. Perhaps one officer in a ship, who has the Journal sent to him, distributes it, but that one copy does not go round the ship, and I am sure the matter contained in these discussions cannot be too widely circulated. A glance at the papers that have been read during the past year, and which are going to be read during this year, will show what a variety of subjects occupy the attention of officers, both of the Army and Navy at the present moment, and also what a variety of opinions are given on every subject—all of them containing much that is good. Every man of experience and ability has his own opinion on these subjects, and they are all of them worth listening to, and yet differing from each other, according to the point of view from which the subject is treated. I think when officers realise this divergence of opinion—and we experience it in this theatre more than in any other room in the country—I think they ought to have a little sympathy for those who have to administer the affairs of the Navy, in the great difficulties that must exist in deciding on what is the right thing to do. There is a maxim which is valuable as a guide in discussions of this sort: "We should be content to believe that no one is infallible, not even the youngest of us." I think that should be taken to heart; nearly everybody has his own views, and thinks they are the remedy for some evil, not remembering that in such matters he must balance the advantages and disadvantages. Everything has to be weighed, and concessions have to be made on both sides. But I ought to follow the example always set on these occasions, and I will not keep you any longer, except to say it has been a great pleasure to me to preside at this Meeting.

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*Where London is the place of Publication, the word "London" is omitted.
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16. Return showing the Expenditure and the Value of the Stores supplied for Military Purposes in the Colonies and Foreign Military Stations during the year 1880-81.
23. Army Estimate for 1883-84.
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25. Estimate of the Sum which will be required to be transferred in Aid of Army Votes in the year ending 31st March, 1884, to meet the Estimated Charge to be incurred in Recruiting, and Training Officers and Men, and in defraying the Non-effective Expenditure for the Regular Forces serving in India.
31. Appropriation Account, 1881-82.
- Index to Report on the Channel Tunnel.
- Return showing with respect to the Infantry and Cavalry regiments present at the action of the 22nd March, 1883: the ages and length of service of the men; the number of men killed or had been killed; the number of regiments, and the number of men.
79. Account, 1881-82.
82. Statement of Excesses, 1881-82.
117. Abstract of the Army Estimates, 1883-84.
146. Army (Guns supplied to the Navy).
182. Return of the Names of the Regiments, and of the strength of the Cavalry and Infantry serving in Egypt and in the Mediterranean on 1st April, 1883: showing the length of service and ages of the Non-commissioned Officers and Men; similar Return of the corresponding (or twin) Battalions of the same Regiment wherever serving, and of the Depôts; Returns of the Number of Horses of the Cavalry serving in Egypt on the same date fit for duty, with a similar Return for the Depôt.
203. Army Estimates (sums required for Naval Services), 1880-81, 1881-82, 1882-83, and the Value of the Supplies actually issued for such Naval Services in the same years.
248. Report on the Channel Tunnel, together with the Proceedings of the Committee, Minutes of Evidence, and Appendix.
284. Account of the Amount due by the Public to Depositors in Military Savings Banks on 31st March, 1881; and of the Receipts, Interest, and Disbursements during the year ending 31st March, 1882.

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By J. Acheson, Esq.

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Sir S. W. Baker, Kt., M.A., F.R.S.

Hinges of Capt. Cooke's Seachest, and Piece of Mast. *J. W. Grover, Esq.*

Helmet Plate, Waist Plate, Forage Cap, Badge, Numerals, Buttons, Gold Lace, and Note Paper with Badge of the 54th Regt. *By Capt. Wingfield,*
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